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AN INDEPENDENT JOURNAL FOR BETTER TRAFFIC

JULY 1958

Cities and New Highways
More Traffic Research Needed
The Regional Center and Downtown
Toll Roads and the Interstate System
Traffic Projection: Economic Background
Thoroughfare Planning and the People
Urban Transportation Programs
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Traffic Quarterly

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Cities and New Highways

The routes of the Federal Highway System tend to link most of the cities of 50,000 population and over. This was not a motivating consideration; it resulted from a more basic attempt to determine areas of lowest travel sufficiency. As a system, the routes selected bear close similarity to the system proposed in an earlier excellent report by the National Interregional Highway Committee, House Document No. 379, 1944.

While the guiding precepts in laying out the system appear fundamental, there are some closely related areas that should be concurrently considered. One of these is city planning and increased traffic in the logically expected growth of the city to assure the full measure of usefulness of this unusual nationwide project.

Much of the discussion on plans and their execution seems principally confined to the sufficiency and pro-rating of funds as provided in the law.

A brief reference to the origin and expansion of our cities should emphasize the importance of city planning's moving hand in hand with any new and expensive road building project.

Historically, our cities have grown from small colonies or settlements. Stories of their early arrivals and growth in the new country are relatively recent and intimate history to an appreciable part of our population today. Much of their growth has been haphazard, rapid and unplanned.

Their locations were influenced by limited contemporary forms of transportation, not necessarily by choice but often by chance, self preservation, or obvious advantages of climate, prosperity or association. Often a wilderness and accompanying dangers were their boundary.

Today we have few planned cities. We are making prodigious efforts to plan some that do not lend themselves well to planning but perforce must be clumsily altered.

Our improved means of penetrating and widely adaptable transportation has made us fully conscious of its many advantages and has broadened our intellectual curiosity to go places. The re-

sulting traffic is stifling our cities and initiating a trend to the country that business views both wisely and with concern.

Communities fortunate enough to be in the broad sphere of influence of the Federal Highway System have a rare opportunity to mend existing faults, to plan and co-ordinate their efforts for future expansion with particular attention to the new highways that can become their future life lines.

The far-reaching importance of this road system as a travelway and the expected growth of cities, create many instances of mutual interest and benefit.

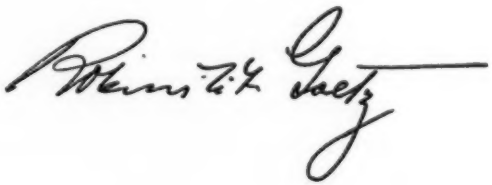
Recognition of this obvious fact should serve to accelerate closer association in the fields of highway engineering and city planning.

Some of the areas in which this co-operation is indicated are zoning, land use, urban renewal, slum clearance and improved traffic facilities.

It is difficult to foresee sensible and courageous progress if well meant efforts are trammeled by conflicting and selfish interest.

To profit by co-operative efforts requires the utmost in mutual understanding and public spirit.

This is not too much to expect.



Traffic Projections: An Economic Background Study

RICHARD W. REED, *Ph.D.*

Doctor Reed, an economist, has been Director of Research for the Illinois State Toll Highway Commission since June, 1956. Previously, he worked with the Vermont Highway Department on the feasibility of a toll road for Vermont and won a $1500 First Prize in the General Motors Better Highways Contest. For his doctoral dissertation, his subject was "Toll Roads in the State Highway System."

ECONOMIC effects of highway construction and motor vehicle use have been receiving more and more attention from engineers and economists. One aspect is the determining of the potential usefulness of a project to the community.

Since vehicular transport is one of the basic forms of transportation and is, therefore, intimately linked with the economic welfare of the community, economic studies that attempt to measure the role of motor vehicle transportation in modern life are valuable to highway administrators and to others concerned with highway policy decisions.

The Illinois State Toll Highway Commission, like other toll highway authorities, is concerned with this problem, since the toll highway must offer a service superior to alternative facilities if it is to attract sufficient patronage and revenue to service its financial and operating commitments. For information on the relationship of the economic activity of the Chicago area to vehicle traffic volumes, a study was made by the staff of the commission.

Circumstances Leading to the Study

Legislation creating The Illinois State Toll Highway Commission was approved in July, 1953. The project moved out of the planning and financing stages in January, 1956, when the largest single bond issue to finance a project of this kind was sold.

Traffic field studies had been made during 1954, and the first

traffic and earnings report was published that December. It was anticipated that the financing for the project would be completed shortly thereafter and that land-taking and the letting of construction contracts would proceed during 1955. Legal problems interrupted this anticipated schedule, however, and the bond financing actually began more than one year after the date originally contemplated. A supplemental traffic and earnings report, based on the 1954 survey, was issued in August, 1955. On the basis of earnings forecast in the latter report, the bonds were sold.

By 1956, the staff of the commission became aware that the economic changes in the Chicago area since the original traffic survey was made had led to a more rapid growth of traffic than expected in 1954. The question of the accuracy of the earlier forecasts became realistic by mid-1957, when it became apparent that the actual costs would exceed the original estimates and that additional financing would be required to complete the project.

Construction costs and potential revenues of the Illinois Toll Highway are interrelated. Certain elements adding to the costs of the project can reasonably be expected to reflect conditions that will increase its revenue potential. The best example of this is the rising land costs, indicating a growing demand for land in the suburban area through which part of the toll highway passes. A rising demand accompanied the rapid residential and industrial growth occurring in the metropolitan area outside the city of Chicago. This development, taking place precisely in the area the toll highway is designed to serve, adds to the traffic potential of that area and therefore to the revenue potential of the toll highway.

In the Spring of 1957, when it became evident that additional financing would be necessary to complete the toll highway, economic studies were started with the specific intent of measuring the amount of additional revenue that might be forthcoming only as a result of the unexpected rate of industrial and residential expansion in the area.

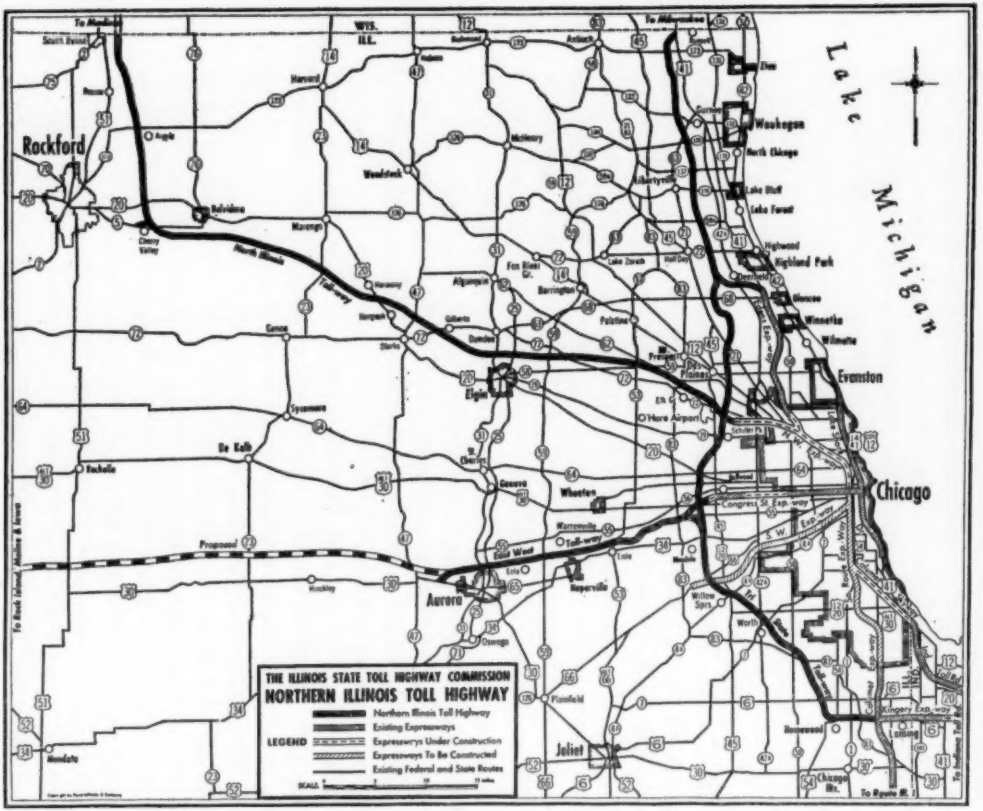
Later it became clear that the magnitude of the additional financing would require an increase in the toll structure. Consequently, a traffic re-survey was ordered by the commission in the Fall of 1957, and the information developed in the economic study was then turned over to the traffic engineers. The economic study

made no attempt to perform the traffic engineering functions that bear on traffic forecasts for the toll highway. That is, the study in no way tried to evaluate the effects of diversion of traffic due to tolls, of the influence of connecting routes, of trip assignments, etc. Rather, the aim of the study was to appraise the long-run growth of the area the toll highway will serve and to estimate the overall traffic growth of the area that could reasonably be expected as a result of the economic growth trends.

Description of the Project

The Illinois Toll Highway, now under construction, consists of three physically connected routes that complement the expressway system of Cook County (see map). The Tri-State Tollway, connecting with the Calumet-Kingery Expressway south of Chicago, is a belt line around the city 83.2 miles in length. It extends north from the Cook County line, joining U.S. Route 41 near the Illinois-Wisconsin border. The Northwest Tollway (formerly called the North Illinois Tollway and so indicated on the map) is a physical extension of the Northwest Expressway. It is 76.4 miles long and will serve the northwest section of Cook County as well as the cities of Elgin, Rockford, and Beloit. Similarly, the East-West Tollway is an extension of the Congress Street Expressway to the western suburbs in DuPage and Kane Counties. It is 27.7 miles long. Roughly three-fourths of the entire toll highway has been designated as part of the federal interstate system.

The reasons for selecting these routes relate fundamentally to the need for limited-access highways as indicated by the level of known and anticipated traffic volumes. The East-West and Northwest Tollways are extensions of the radial expressways in the Cook County system. Also, the Northwest Tollway constitutes an important link in the Interstate System between Chicago and Minneapolis. The Tri-State Tollway is the only circumferential limited-access route around Chicago and will perform three important functions: (1) it will serve as a by-pass route around the heavily congested portions of the city, (2) it will move traffic from one radial expressway to another, and (3) it will serve the contiguous suburban communities around the city.



The Illinois Toll Highway consists of the Tri-State Tollway, the East-West Tollway, and the Northwest Tollway.

In addition, important traffic-generating points exist near both ends of the Tri-State Tollway. Lake County, Indiana, has a population currently estimated at nearly one-half million. Milwaukee, situated thirty-three miles north of the U.S. Route 41 connection, has one million.

The entire facility is being built to high design standards. The roadway has no less than four lanes, with six lanes provided in sections where higher traffic densities are expected. It has wide shoulders and median strips, long acceleration and deceleration lanes, and no intersections at grade.

The main roadway is designed to permit speeds of sixty m.p.h. in urban sections and seventy m.p.h. in rural. Pavement widths of thirty-seven feet for three-lane and twenty-five feet for two-lane single-direction strips will be provided. An outside paved shoulder of eleven feet will accommodate vehicles temporarily disabled, and along the median strip a five-foot paved width is specified. A median strip of thirty feet in six-lane sections and fifty-four feet in four-lane sections will be provided.

Guard rail will be installed on all embankments exceeding ten feet in height, and the entire right-of-way will be fenced. The right-of-way is 250 feet wide in urban sections and 300 feet wide in rural sections. There will be no traffic signals and no intersections at grade on the toll highway. Five service areas will provide restaurant and gasoline service facilities to toll highway patrons.

Tolls will be collected at various barrier stations on most sections. On that section of the Northwest Tollway west of the Fox River the "closed" system of toll collection will be used, where the traveler obtains a ticket at the beginning of his trip and pays the toll and surrenders his ticket at the end.

The Toll Highway Commission has contracted with the Illinois Department of Public Safety for a police patrol unit to provide service to motorists and to enforce traffic regulations. The commission will pay all expenses of the police unit, including training by the department and a special training session to familiarize patrolmen with the special problems of toll highway service.

A complete micro-wave communications system, sufficient to service police, toll audit, and maintenance requirements, will be installed. Headquarters of commission administrative and mainte-

nance activities will be centered at two buildings, the administration building and the central shop, situated on the East-West Tollway near the junction with the Tri-State Tollway.

Gathering the Information

The first step in the study was to assemble a great variety of data relating to the Chicago area. Such information as industrial composition and development, the character of service industries and cultural institutions, the development of all transport facilities, and the growth of utilities was examined. The pattern of the distribution of population and industrial activity also was studied.

Of particular concern was the selection of certain measures that could be related to motor vehicle use. Attention was focused on three basic series of data obtained over a base period of 1950 to 1956. The series included population, disposable personal income (that is, personal income after the deduction of income taxes) and motor vehicle registrations.

In each case, data were gathered for the United States and Illinois as well as for the six-county Chicago Standard Metropolitan Area (S.M.A.), the city of Chicago, and the metropolitan ring. The last term is used in a special sense that does not correspond to the U.S. Bureau of Census definition of the term. Specifically, the metropolitan ring as here used includes Cook County outside Chicago, DuPage, Kane, and Lake counties. This area may be considered the *zone of influence* of the toll highway within the Chicago S.M.A.

Important facts developed by these statistics are noted in Table I. On July 1, 1956, the population of the United States was estimated at 167.2 million and that of Illinois 9.4 million. The Chicago S.M.A. on that date was estimated to have 6.3 million persons, or two-thirds the population of Illinois and about 3.8 percent of the nation. The entire Chicago S.M.A. had about 3.2 percent of the nation's registered motor vehicles and about 5 percent of the nation's disposable personal income in 1956.

The Chicago metropolitan ring had a population estimated at 1.96 million in 1956, this being thirty-one percent of the population of the Chicago S.M.A. and twenty-one percent of the population of

Illinois. It is significant that while seventy-seven percent of the route mileage of the Toll Highway lies in the metropolitan ring, eighty-seven percent of anticipated toll revenues will be generated there. In short, the bulk of toll highway mileage traverses areas of dense population. Heaviest densities are found close to the Chicago city limits.

Table I

POPULATION, PERSONAL DISPOSABLE INCOME, MOTOR VEHICLE REGISTRATIONS, 1956 FOR THE U.S., ILLINOIS AND THE CHICAGO AREA

	Estimated Population July 1 (thousands)	*Motor Vehicle Registrations (thousands)*	*Total Personal Disposable Income (millions)*
1. United States	167,191	65,213	$287,202
2. Illinois	9,432	3,534	19,544
3. Chicago S.M.A.*	6,331	2,066	14,251
4. Metropolitan Ring	1,965	791	4,822
5. Boone—McHenry—Winnebago	255	121	502
6. Cook Co.—Total	5,025	1,555	11,814
7. Cook Co.—Chicago	3,729	1,043	8,670
8. Cook Co.—outside Chicago	1,295	512	3,266
9. DuPage Co.	244	102	583
10. Kane Co.	182	77	367
11. Lake Co., Ill.	244	100	561
12. Lake Co., Ind.	460	165	947
13. Will Co.	165	67	296

*The Chicago Standard Metropolitan Area consists of the following counties: Cook, DuPage, Kane, Lake and Will in Illinois and Lake County, Indiana.

The Economic Analysis

The aim of the economic analysis was to estimate the traffic potential generated by the economy of the metropolitan ring. A good economic indicator of traffic potential is disposable personal income.

This has been established indirectly by relating income to the number of motor vehicles registered in an area, since estimates of vehicle-miles generated in an area smaller than a state usually are not made periodically. The ratio of vehicles to disposable personal income varies from region to region, but for any particular region the ratio remains fairly constant over time, subject to modifications to be discussed.

To test this proposition for the Chicago metropolitan ring, ratios comparing the number of vehicles registered for each $10,000 of disposable personal income (deflated) were calculated for 1951 through 1956. The *low* year was 1951 with a ratio of 2.07; the *high* year, 1954, had a ratio of 2.27, and the annual average was 2.15. Following this, the two sets of figures were analyzed to determine the degree of co-variation, and a coefficient of correlation of .980 was found.

Even though values for only a few years were used, the coefficient of correlation is high, 1.000 representing a perfect positive correlation. Consequently, it can be stated with confidence that motor vehicle registrations vary directly with income in the Chicago metropolitan ring.

The value of having established this high correlation is that the growth of traffic potential can be related to the growth of disposable personal income. Since the number of vehicle-miles traveled per year for the average motor vehicle also is fairly constant, the actual volume of vehicle usage of highways can be projected. Travel potential, therefore, varies directly with income.

Income, in turn, varies with changes in business conditions. To this extent projections of motor vehicle use cannot be expected to match actual vehicle travel each year, and such projections attempt to show trends over a number of years. It should not be assumed, however, that personal disposable income is highly variable over the business cycle. Compared with other indexes of business activity, such as tonnage of steel produced, freight car loadings, stock market prices, unemployment, etc., personal disposable income is relatively stable.

Moreover, consumer expenditures for private transportation are quite stable. It has been found that the automobile is one item that individuals will tend to keep even when they are forced to sacrifice their consumption of other goods and services in periods of declining income. Total expenditures for motor vehicle travel have averaged 9.4 percent of total disposable personal income in recent years, and rarely has the figure for any one year deviated more than one percent from that average.

Of equal importance is the fact that expenditures for private transportation have a high income elasticity. That is, the "average"

person receiving a given income spends a certain portion for his car, for gasoline. If he receives an increase in his income, he will spend a larger portion of the increase for private transportation than he spent of his total income for that item before his income increased.

This is certainly the case for persons in the low and medium income brackets, who receive about three-quarters of total personal income. It does not hold for persons in the very low or high income brackets. Nevertheless, it is generally true that the higher the personal income, on the average, the greater is the fraction of that income spent for automobiles and private travel.

The amount of traffic potential actually realized is influenced by the location of family dwellings relative to commercial, industrial, educational, recreational, shopping, and governmental centers. An important consideration here is the availability of adequate highway capacity.

Differences in the ratio of vehicle registrations to income among regions was previously noted. This ratio is likely to be higher in areas (1) where mass transportation is not well developed, (2) where the construction of modern highways has progressed rapidly, and (3) where the economy of the region by its nature requires the extensive use of motor vehicles.

In large cities where mass transport media are highly developed, figures generally reveal lower registrations per unit of income than for smaller cities or towns where mass transport is less highly developed. The high proportion of vehicles to incomes in California, compared with many other states, illustrates the second point.

In this regard, the improvement of highway transportation in the Chicago area with the opening of the Toll Highway and other expressways can be expected to stimulate automobile ownership and operation and may in time modify the existing relationship of motor vehicles to disposable personal income.

Finally, areas where agriculture is the dominant economic activity generally show higher rates of vehicle registration per capita or per dollar of income than do the urban areas.

Table II presents compound annual percentage rates of growth for income, population, and motor vehicle registrations. The growth rates are presented in such a way as to facilitate comparisons among

the nation, state, and the various subdivisions of the state, which are of principal concern here.

The population growth figures indicate that while Illinois as a whole is somewhat below the national average, the Chicago area is undergoing considerable growth. The metropolitan ring, with nearly one-third of the population of the six-county metropolitan area, had population increases more than double that of the entire S.M.A. The rapid rates of both population and income growth in the suburbs of course reflect the rapid outward expansion from the central city.

Table II

RATES OF GROWTH OF POPULATION, PER CAPITA DISPOSABLE PERSONAL INCOME, TOTAL DISPOSABLE PERSONAL INCOME, AND MOTOR VEHICLE REGISTRATIONS: 1950–1956

(*Compound Annual Percentage Rates*)

	Total Disposable Personal Income[1]	*Per Capita Disposable Personal Income*[2]	*Population*	*Motor Vehicle Registrations*[3]
1. United States	3.56	1.75	1.68	4.82
2. Illinois	3.86	2.66	1.28	4.36
3. Chicago S.M.A.	5.08	2.74	2.39	5.39
4. Metropolitan Ring	9.33	3.22	5.92	8.31
5. Boone—McHenry—Winnebago	3.41	1.05	2.34	4.09
6. Cook Co.—Total	4.35	2.56	1.85	4.63
7. Cook Co.—Chicago	2.93	2.46	0.49	3.04
8. Cook Co.—outside Chicago	9.25	2.86	6.49	8.50
9. DuPage Co.	13.34	5.45	7.85	10.02
10. Kane Co.	4.77	1.62	3.28	5.86
11. Lake Co., Ill.	9.44	4.12	5.30	7.74
12. Lake Co., Ind.	7.94	4.14	3.78	8.55
13. Will Co.	6.68	3.17	3.54	6.18

1. Other general indicators in compound annual percentage rates, 1950 to 1956:

Gross National Product,	3.85
Personal Income: U.S.	3.87
Illinois	3.72

2. Corrected for price level changes.

3. Annual compound percentage rates of traffic increase 1950 to 1956, main rural roads:

U.S.	5.26
Illinois	4.27

As a further check on population growth in the immediate vicinity of the toll highway, the population data for eighty-three towns and villages within three miles of the toll highway right-of-

way were tabulated for 1950. This check included towns and villages outside the metropolitan ring as well as within that area.

Later population figures were obtained from special censuses taken frequently in Illinois communities because the gasoline tax fund distribution formulas in the statutes are based on population. The population figure for these eighty-three communities was estimated in excess of 950,000 in mid-1956, and a growth rate of 6.48 percent a year was calculated for the six-year period, 1950 to 1956.

Income in Illinois during the 1950–1956 base period was increasing somewhat more rapidly than in the nation. Yet the motor vehicle registration rate in the state was below that of the nation. In addition, while the national rate of increase of vehicle registrations was about one-third above the national rate of increase of disposable personal income, in the Chicago S.M.A. vehicle registrations exceeded the income rate by only six percent over the six year period. This suggests that the Chicago area has a potential for a faster rate of growth, particularly as the suburbs grow away from mass transit and more highway facilities are provided.

Traffic on the existing roads in the traffic corridors that will be served by the toll highway is increasing at a rate faster than the state-wide average. This is evident from a comparison of traffic flow maps issued by the Illinois Division of Highways in 1950, 1953, and 1956.

Routes farthest from Chicago are experiencing the lowest rates of growth, with rates increasing as one progresses toward the city. The phenomenon is not unique to Chicago. The U.S. Bureau of Public Roads in its memorandum "Guide to Forecasting Traffic on the Interstate Systems" (October 15, 1956) stated that in suburban locations near cities, growth rates could be expected on radial routes equal to 1.34 times the state-wide traffic percentage increase, and 2.24 times the state-wide rate of increase on circumferential routes.

Before making a forecast of traffic growth in the area, the economic growth of Illinois was related to the growth of the United States as a whole. Although the growth of Illinois is due in part to unusual regional and local influences, it also is affected by the growth of the national economy. Following this, a forecast of the

growth of disposable personal income for Illinois was made, based on a conservative projection.

In general the period 1950 to 1956 is one of a high level of economic activity. Although this level is not expected to be maintained in the immediate future, the assumption is made that the nation will not have a deep or prolonged depression.

Taking the various economic trends into account as well as the trend of vehicle registrations, the conclusion was reached that the potential traffic growth within the metropolitan ring of Chicago would amount to seven percent a year during a period of seven to ten years following the opening of the toll highway to traffic. The time limit is suggested since it is believed that by that time most of the industrial and land areas near the toll highway that now are undeveloped will have been built up.

Any expansion that continues after the end of a decade will take place in areas sufficiently removed from the toll highway for the influence to be less noticeable than earlier development near the right-of-way, particularly near the Tri-State Tollway.

Recent Traffic Re-Survey Findings

In the traffic and earnings report of December, 1954, traffic engineers indicated an expected rate of traffic growth in the area served by the toll highway to be five percent a year. The traffic re-survey was made during November, 1957, and the findings of the engineers were published in the report of February, 1958. Traffic figures in the report may serve as a rough check against the forecast made above.

Using traffic information furnished by the State Division of Highways, annual daily traffic volumes were established for seven screenlines along roads from which traffic is expected to be diverted to the toll highway. From 1950 to 1956, the average annual rate of traffic increase at these screenlines was 6.4 percent. At twenty-three stations where traffic counts were tabulated in 1956 and 1957, the one-year increase was found to be 6.3 percent.

These counts cover the entire toll highway, including traffic on the rural sections which is growing more slowly than that on the urban sections. To the extent that they reflect the actual vehicle

traffic in the area, the counts indicate growth rates somewhat below the figure forecast, but it should be noted also that they are well above the five percent annual rate of growth expected in 1954.

In summary, a method of economic analysis and trend forecasting has been described that was used for forecasting traffic growth in the Chicago area to be served by the Illinois Toll Highway. The analysis does not forecast actual traffic volumes on the toll highway. Because of the suburban location of major portions of the highway and the rapid expansion of industrial and residential construction in that area, the traffic and revenue potential of the facility is expected to grow rapidly during the first seven to ten years of operation.

The technique of analysis is based upon the observed fact that the amount of spending for private transport tends to bear a constant relation to the disposable personal income of persons in an area.

In turn it is related to the population and economic activity of the area. This type of analysis should prove useful in forecasting traffic growth over extended periods for other regions, since vehicular traffic is an integral part of the basic economic life of any community.

Toll Roads and the Interstate System

ROBERT L. MITCHELL

Mr. Mitchell is a partner of the municipal bond law firm of Mitchell, Pershing, Shetterly and Mitchell, New York, N. Y. His firm confines its practice to legal matters with relation to the issuance of state and municipal bonds and other obligations. Among the revenue bond issues they have approved as bond counsel have been those to finance the toll roads in Kansas, Kentucky, Maine, Massachusetts, Ohio, Oklahoma, Pennsylvania, Virginia and West Virginia. In addition, they have drafted the necessary enabling legislation for toll roads in many states.

IMMEDIATE and widespread reaction to the Federal-Aid Highway Act of 1956 (70 Stat. 374) and its impetus to the construction of the National System of Interstate and Defense Highways was that it jeopardized the financial solvency of toll roads or turnpikes already in operation or shortly to be in operation, and doomed the construction of more such facilities. The purpose of this discussion is to examine, two years after the passage of this controversial piece of legislation, the extent to which this first reaction has been realized, and to consider some of the relationships between toll roads and the interstate system.

The second session of the 84th Congress in enacting the Federal-Aid Highway Act of 1956 provided the financial means, based on the then estimated cost, of completing the interstate system over a thirteen-year period. The Congress expressed its intent that the entire system be simultaneously completed in all the states. Unique in the Federal-aid highway program was the provision in this act that the federal share payable on account of any project on the interstate system would be ninety percent of the project's total cost.

The Congress further provided that the "geometric and construction standards to be adopted for the interstate system should be those approved by the secretary of commerce in co-operation with the state highway departments" and that such "standards shall be adequate to accommodate the types and volumes of traffic forecast for the year 1975." These standards were established within a month of the passage of the act.

The Federal-Aid Highway Act of 1944 (58 Stat. 838) had

authorized 40,000 miles for the interstate system, the general locations for which had been selected and approved in 1947 and 1955. The 1956 Act added an additional 1,000 miles to the interstate system. Following the selection of detailed route locations, it was announced that the approved system totaled only 38,548 miles. In October 1957, new routes totalling 1,102 miles were added within the original 40,000-mile limitation and 1,000 miles of new routes were added as authorized by the 1956 Act.

Recognizing that existing toll roads and those already under construction were wholly or partly located on routes designated in the interstate system, Congress in the 1956 Act authorized the secretary of commerce to approve as part of the interstate system any toll road, toll bridge, or tunnel now or hereafter constructed that meets the standards adopted for the improvement of projects located on the system or on a route heretofore or hereafter designated as a part of the system. The secretary's approval is to be based on a finding that such action will promote the development of an integrated interstate system. The 1956 Act authorizes the expenditure of funds on an interstate system project approaching any toll road either where such project will have some use irrespective of its use for such toll road or, upon meeting certain prescribed conditions, where the project has no use other than as an approach to such toll road.

Of more apparent than real significance with respect to toll roads was the section in the 1956 Act, relating to reimbursement for certain highways on the interstate system. This section reads as follows:

> "It is hereby declared to be the intent and policy of the Congress to determine whether or not the federal government should equitably reimburse any state for a portion of a highway which is on the Interstate System, whether toll or free, the construction of which has been completed subsequent to August 2, 1947, or which is either in actual use or under construction by contract, for completion, awarded not later than June 30, 1957:
>
> *Provided*, That such highway meets the standards required by this title for the Interstate System. The time, method, and amounts of such reimbursement, if any, shall be determined by the Congress following a study which the Secretary of Commerce is hereby authorized and directed to conduct, in co-operation with the state highway departments and other

agencies as may be required, to determine which highways in the Interstate System measure up to the standards required by this title, including all related factors of cost, depreciation, participation of federal funds, and any other items relevant thereto. A complete report of the results of such study shall be submitted to the Congress within ten days subsequent to January 2, 1958."

The purport of this section is merely to postpone until further information is available to the Congress the determination as to whether any reimbursement shall be made and, if so, how much, when, and in what manner.

Toll Roads Included in the Interstate System

The first direct action after passage of the 1956 Highway Act was taken in August 1957, pursuant to the authority of the secretary of commerce to approve toll roads as part of the interstate system. At that time Federal Highway Administrator Bertram D. Tallamy announced that 2,102 miles of toll roads in fifteen states had been recommended by the appropriate state highway departments for inclusion in the interstate system. These recommendations had been approved by the Bureau of Public Roads of the U. S. Department of Commerce. Inclusion of these toll roads in the interstate system should prove beneficial in eliminating the duplication of toll roads meeting the system's standards and in permitting immediate construction of other needed portions of the system. The toll roads themselves which have been included in whole or in part in the system enjoy a status they did not have before.

Included in the interstate system are the entire routes of the toll roads in five states – Indiana, Kentucky, Massachusetts (except for a short section at the west end), Oklahoma and Virginia. For all practical purposes New York can be classified with this group of states because only a few short connecting links of its toll road system have not been included in the interstate system.

If anything, the financial solvency of these toll roads should be assured rather than jeopardized. They are promised that, if not already connected to completed portions of the interstate system, they will be in due course and will receive direct benefit from the traffic generated by the system. Conversely, they are relieved of

the threat of a free parallel highway of comparable standards. With but one exception known to the writer, the threat of competition has always been present in toll-road financing because of the constantly increasing need and demand for more and safer highways.

Except for a short section at the eastern end, all of the Pennsylvania toll road network on a route of the system has been included in the system. The remaining mileage is on a route that to date has not warranted inclusion in the interstate system. Pennsylvania therefore will receive all the benefits of the interstate system to the extent of the included mileage, but will not suffer any important disadvantage because of the mileage that could not be included.

Portions of Some Toll Roads Included

In seven states – Connecticut, Florida, Illinois, Kansas, Maine, New Hampshire and Ohio – only a portion of the toll roads have been included in the interstate system. However, even here it is premature to predict any net long term adverse effect on the earning capacity of any of these toll roads because of the building of the interstate system. Experience indicates that construction of a new highway facility only temporarily relieves the existing facilities and that they soon again regain the traffic volumes existing before the construction of the new facility. Offsetting any temporary loss is the gain realized by having the remainder of the toll road incorporated in the interstate system.

The remaining state to have only a portion of its toll roads included in the interstate system is New Jersey. Only the short section of the New Jersey Turnpike from Newark Airport to Holland Tunnel was recommended by the state for inclusion in the system. The rest of the turnpike and the entire Garden State Parkway are not included.

In addition to the states mentioned above, Texas and West Virginia have toll roads. (The Denver to Boulder 17-mile toll road in Colorado has not been included in this discussion because of its limited significance in national and state highway policy.) The short toll road in Texas has not been included in the system, and at the time of the August 1957 announcement the West Virginia toll road was not on an interstate system route.

Among the new routes added within the original 40,000-mile limitation in October 1957 was the route from Canton, Ohio, to Charlotte, North Carolina, which could include the West Virginia toll road. As of this writing no decision had been made to include the West Virginia toll road in the interstate system. Nor has any indication been given as to whether this toll road meets the standards of the interstate system.

At the moment approximately seventy percent of the toll road mileage has been included in the interstate system, representing only about five percent of the total 41,000 miles of the interstate system. Inclusion in the system in no way changes the nature of these toll roads as such. It is, however, a necessary first step as presently set forth in the Federal-Aid Highway Act of 1956, precedent to the reimbursement of a state for any toll road if Congress should so determine.

Interstate System in Competition with Toll Roads

From the foregoing it can be seen that, while the bulk of the toll road mileage has been included in the interstate system, several states face a potential threat that the system will be constructed in direct competition with all or a portion of existing toll facilities. And the significant question is when this competition will take place.

If the competition becomes effective early in the construction program, the toll roads that are not living up to their estimates of revenue or have not yet reached their predicted traffic volumes could be in serious financial difficulty. In these situations the obvious answer to both the toll road operators and the planners of the interstate system should be that an early programming of that portion of the interstate system is not justified. If the interstate system is to cost more and take longer to construct than was originally estimated – as seems probable – it would appear that available funds could be used more advantageously in the early stages on other parts of the interstate system. By the end of the construction program every toll road should be able to withstand the competition. If not, its financial difficulties could be due more to weaknesses in the toll road's original conception than to competition caused by the interstate system.

While the federal highway administrator and the Bureau of Public Roads rely generally on the highway department of a state for the interstate system programming in that state, it is not their present policy to approve the construction of competitive facilities. While this is a policy decision and not a matter of law, it should encourage toll road authorities and state highway officials in the respective states to settle their differences, where they exist, promptly so as neither to delay the construction of the interstate system nor harm the financial soundness of the toll roads.

In their desire to take full advantage of the 1956 Federal-Aid Highway Act, state highway officials should not forget the reasons and circumstances that led to the financing and construction of toll roads. They were constructed to meet an urgent and existing traffic problem when the states themselves lacked the necessary financial resources. In most cases, these toll roads could not have been constructed without the approval of the state highway department. Now that federal funds are being made available, a little good faith and patience are necessary through this adjustment period.

On balance it would appear that the interstate system can't help but be beneficial to the present toll roads. The only threat in sight is that some portions of the system that are competitive with all or part of a toll road will be constructed early in the program and before that toll road has reached financial maturity.[1]

Reimbursement for Toll Roads

Pursuant to the provisions of the 1956 Act section quoted earlier, Secretary of Commerce Sinclair Weeks reported to Congress in January 1958, that of the 38,548 miles of approved detailed locations on the interstate system as of September 1957 (the 2,102 miles added in October 1957 were not included for the purpose of this report) 10,859 miles met the criteria for consideration for reimbursement. In this mileage were 1,950 miles of toll roads, bridges and

1. Of interest on the subject of competition with toll roads would be the answer to the question whether the secretary of commerce, once having approved a toll road as part of the interstate system pursuant to the provisions of the Federal-Aid Highway Act of 1956, could thereafter withdraw the approval. If denied reimbursement for toll roads, would the states seek to have approvals withdrawn?

tunnels[2] with a total cost of $2.59 billion, and a total cost-less-depreciation of $2.52 billion.

These figures excluded so-called nonhighway costs – financing costs including capitalized interest and bond discount; administrative costs; costs of all facilities necessary because toll-operated rather than as "free" highways; cost of maintenance and operation facilities, and cost of concession areas. The report was entirely factual and did not make any recommendations as to the time, method and amount of reimbursement.

The theory of reimbursement is that it would be inequitable to fail to give tangible recognition to states that have already undertaken the construction of highways, whether toll or "free," on the interstate system. Stating it another way, failure to make reimbursement would penalize those states most successful in building portions of the interstate system without the benefits of the 1956 Federal-Aid Highway Act, particularly the provision that the federal share of any project will be ninety percent of its total cost.

It is argued to the contrary that these highways were constructed without any thought or knowledge of possible reimbursement and that any reimbursement would constitute a windfall. It is also argued that to the extent a state has anticipated the construction of such highways, it has already gained substantial benefits.

Two general methods of reimbursement have been suggested. First, reimbursement could be such that the state would have additional federal funds for additional highway construction. Second, reimbursement for toll roads could be designed to free these roads from tolls.

Legislation presented to Congress follows the first method and would give each state additional mileage on the interstate system equal to the mileage of its approved toll roads, or would permit a state to construct an equivalent mileage on the Federal-Aid primary highway system with the federal share payable because such highways would be increased to ninety percent of their total cost. A mileage-for-mileage reimbursement plan without regard to the relative construction costs would not make too much sense. Con-

2. The original Pennsylvania toll road was completed prior to August 2, 1947 and therefore excluded on the basis of the stated criteria. It is, however, included in the interstate system.

struction and design factors produce great variations in per-mile costs and should be recognized, whether more or less mileage may be constructed because of the reimbursement.

Of more significance to toll roads and their bondholders are the possibilities inherent in the second form of reimbursement. Justification for this method is based on the undesirability of having the interstate system, when completed, part toll and part non-toll. It is also contended that for the most efficient and economical administration and operation all highways in a state should be the responsibility of one agency, the duly established highway department of the state. This contention overlooks the fact that there was no legal necessity for the creation of a semi-independent authority or commission to finance, construct and operate a toll road.

Of the states discussed herein, Connecticut, Kentucky and New Hampshire did not create a separate agency. But in most states the semi-independent authority or commission was believed to be the more business-like way of bringing into being at the earliest date possible the particular highway facility. It was thought that a new agency dedicated to a single purpose could proceed more expeditiously and be freer of outside influences. Whether or not the semi-independent authority or commission has lived up to expectations is another subject.

In most states, upon retirement of all outstanding obligations secured by tolls, the road will be freed of tolls and turned over to the state highway department to be operated and maintained as a part of the state highway system.

Reimbursement for the purpose of freeing a road from tolls would necessarily involve the retirement of all outstanding revenue bonds issued therefor, since all of the road's tolls and other revenues would have been pledged to bond payments until the last bond should be retired. We must assume that such bonds would be subject to redemption in whole at par or some applicable premium at the option of the issuer from any funds that may be made available for such purpose.

Reimbursement presumably would be based on ninety percent of the total cost of construction of the toll road, less depreciation and excluding the so-called nonhighway costs. Except to the extent that bonds would already have been retired from revenues and

that funds accumulated from earnings might be available in the sinking fund, the state might have to produce from other sources as much as thirty percent of the amount of the original bond issue in order to have sufficient money, with the amount of the reimbursement, to retire all of the outstanding bonds. Also, of course, freeing of the toll road would burden the state with additional expenses of maintenance, repair and operation.

A question has been raised as to whether reimbursement funds could be used to retire bonds if the issuing body is a semi-independent authority or commission and the reimbursement is made to the state. It is inconceivable that any legal obstacle in this regard would be presented that appropriate state legislation, supplementing the federal legislation providing for the reimbursement, could not cure. The bondholders' contractual rights would not be impaired so long as the redemption took place in accordance with the terms of the instrument providing for their issuance.

This method of reimbursement would appear to be even less attractive in a state where only a portion of a toll road has been included in the interstate system. The portion of the toll road included in the system can not alone be freed of tolls because of the covenants and pledges made to bondholders. In order to take advantage, then, of reimbursement in this form a state might possibly have to provide an even greater percentage than the thirty percent indicated above.

Perhaps the greatest objection to the second method of reimbursement as compared to the first is that it does not provide for any new construction of highways. In view of the present concern about our economy and the increased estimate of cost to construct the interstate system, this objection has more force today than at the time of the passage of the 1956 Federal-Aid Highway Act.

The Future for Toll Roads

With regard to toll roads that have already been financed and are now or will soon be in operation, there seems little doubt that the long-term effect of construction of the interstate system will be favorable. For their part, these toll roads have met a pressing need for high-speed traffic arteries on many important and heavily

traveled highway routes. While certainly not the answer to the entire highway problem or even to the traffic problem on the more densely traveled interstate system routes, the modern toll roads, financed without recourse to general funds of the states, provided facilities when other funds were either not available or were being exhausted in piecemeal fashion on all the roads and highways of the states rather than being concentrated on routes of heaviest traffic density.

As to financing and constructing more toll roads in the future the picture is neither clear nor optimistic.[3] Some investors and investment bankers have expressed the view that the investing public will not again readily accept revenue bonds payable solely from the earnings of a toll road project where the financing is based entirely on estimates of construction cost, operation and maintenance expenses, traffic, and revenues.

This opinion is explained in part on the grounds that interest rates are generally higher today; the results in a number of instances have not lived up to expectations because of a variety of factors; the most needed projects have already been financed and constructed, and the states will prefer to construct their routes on the interstate system with ninety-to-ten money. An exception is immediately grafted on to this general proposition if the new project is an extension of an existing proved project even though not combined for financing purposes with the existing project. This is particularly true if the new project connects the existing project with a densely populated urban area.

It would appear premature at this time to rule out all forms of toll road financing. In 1956 the interstate system was estimated to cost $27.6 billion and was to be completed in thirteen years. The secretary of commerce last January reported a revised cost estimate of $37.6 billion; this figure did not include any amount for the 2,102 additional miles added to the interstate system in October, 1957. And, depending on how accurate the revised cost estimates are and whether Congress will take any action to make more funds available for the program, the construction period for the interstate system could be of a twenty-year duration or even longer.

3. The thoughts expressed here are not necessarily relevant to toll bridges and tunnels.

With this possibility in mind, together with the difficulty of providing the ten percent matching funds as well as the funds to operate and maintain these new additional highways, and the difficulty of asking the public to wait twenty years for needed highway facilities, it is not too much to expect that some states will turn again to some form of toll road revenue financing. In addition, many heavily traveled routes not included in the interstate system may have to be provided through the issuance of revenue bonds.

The modified forms of toll road financing that could be used, and have already been used to some extent, involve one or more of the following alternatives in addition to the pledge of tolls and other revenues of the project for payment of the bonds: a pledge of the gasoline taxes generated on the project; a covenant on the part of the state to pay all operation and maintenance expenses of the project from other funds; a pledge of all highway-user revenues of the state to the extent necessary to make up any deficiency in the sinking fund for the bonds; and a pledge of the state's full faith, credit and taxing power for payment of the bonds.

This additional security could make a project feasible or reduce the interest cost to the issuer. Methods have been and can be devised to prevent abuses in the use of such additional security. Certain forms of additional security might not be available in many states because of constitutional provisions and their judicial interpretation. In any event statutory authorization is necessary.

There is the possibility that revenue financing, including some form of additional security or even financing based on revenues alone, might be used in agreements with the federal government whereby the states could anticipate their future federal appropriations and construct portions of the interstate system sooner than might otherwise be the case if they had to wait until the funds are in hand.

By combining the best elements of all present means of financing routes on the interstate system, the states and the traveling public might see the entire system in operation in a relatively few years. Appropriate federal, as well as state, legislation would undoubtedly be necessary.

Whether the toll road technique of financing our highways has any further use will depend on many factors that will vary from

situation to situation. Once having decided to accelerate our highway program, we have to resolve the method and manner of paying for it. Despite the label "free," we have long since discovered that there is no such thing as a free highway. If not paid for by tolls, highways must be paid for by taxes collected either by the states or by the federal government.

Research Needed to Keep Pace With Changing Traffic Trends

O. K. NORMANN

Since 1928, Mr. Normann has been employed in the Bureau of Public Roads. He is probably best known for his research in the field of highway capacity. As Chairman of the Highway Research Board Committee on Highway Capacity, Mr. Normann organized nationwide field studies and supervised the assembly and interpretation of data that resulted in publication of the "Highway Capacity Manual." This book is a world-wide standard and has been translated into four foreign languages. Mr. Normann is the author of numerous articles on traffic engineering. He has been accorded the Roy W. Crum Distinguished Service Award of the Highway Research Board, the Department of Commerce Medal for Meritorious Research, and in 1957, the first Theodore M. Matson Memorial Award, given "in recognition of the advancement of the science of traffic engineering."

THE largest road-building program in our history is now well under way and progressing on schedule at a gratifying rate. Improved and new operational skills will be required to insure the smooth, safe flow of expected traffic moving in greater volume and speed than ever before.

The National System of Interstate and Defense Highways, with full access control, will require new techniques for handling traffic through proper signing, marking and other controls to assure that freeways and existing facilities will function as an integrated highway system. It is through continued research in traffic control, driver behavior, highway geometry, and planning activities closely associated with highway development – such as land use – that the greatest possible benefits, both economic and social, can be realized.

One of the basic items of information needed for highway design and traffic control is the speed at which drivers operate their vehicles under various highway and traffic conditions. Since the automobile became a common means of transportation, horsepower and speed

Editor's Note: Parts of this article appeared in an address by Mr. Normann on the occasion of his acceptance of an award presented to him by the Theodore M. Matson Fund, Inc.

capabilities of vehicles have increased from year to year. The most substantial increase took place in the change between the 1954 and 1955 models of most makes.

Figure 1 illustrates the increase in the speed potential of American stock cars prevalent on our highway systems. The notable in-

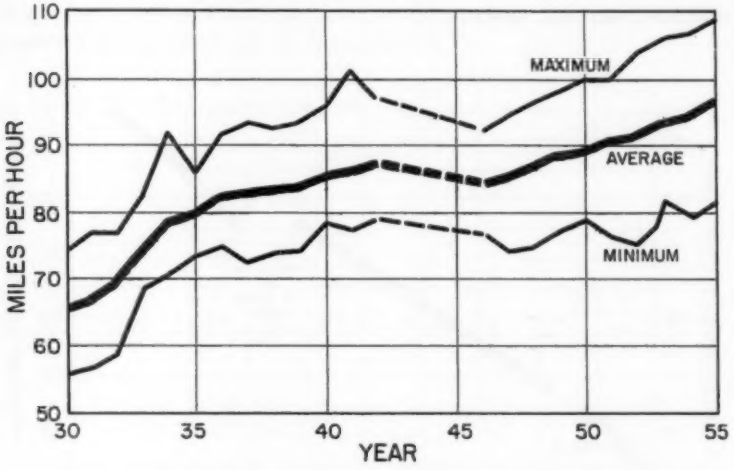


Figure 1. Trend of maximum car speed from 1930 to 1955.

crease in horsepower from 1954 to 1955 is not reflected in maximum speed. The average 1941 model was capable of a speed of 86 miles per hour, with a range of from 78 to 101 mph. The possible speed of the average 1955 model was 97 miles per hour, with some capable of about 110 mph. Stock car speeds are again maintaining their relative position with the vehicles used in the Memorial Day races on the Indianapolis Speedway as shown by Figure 2.

Vehicles are seldom operated at these high potential speeds on public highways. In 1941, the average passenger car speed during low traffic volumes on straight level sections of rural highways, then considered of modern design, was about 48 miles per hour. Today's vehicles, at the same locations and under the same highway and traffic conditions, average about 52 miles per hour, an increase of only four miles per hour over a sixteen-year period.

This four-mile-per-hour increase reflects the change in speed that has taken place with the change in vehicle design and driver behavior under unchanged highway conditions; it is based on periodic studies conducted at hundreds of locations throughout the country on some of the best roads available in 1941. Only those sections that have remained essentially unchanged have been restudied from year to year.

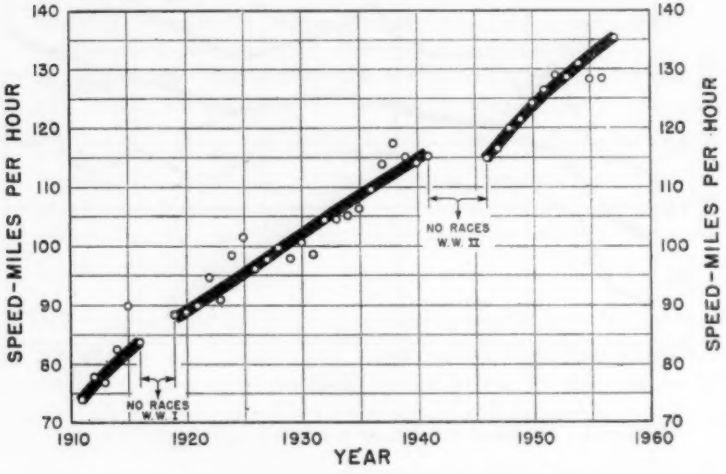


Figure 2. Average speed of winner in Memorial Day races on Indianapolis speedway.

Speeds Increase with Improved Design

But speeds on modern highways today are considerably higher than on the best roads of 1941. In 1941, it was rare to find a location where the average speed was above 50 mph. Today, there are any number of locations where the average speed exceeds 55, and those with an average above 60 are now more common than those with an average above 50 in 1941.

The highest average speed recorded at any location to date has been about 64 miles per hour, with about 94 percent of the vehicles exceeding 50 and nearly 25 percent exceeding 70. This occurs

within states that have a posted maximum of 60 mph as well as in states with no maximum limit.

The combined change in speed resulting from improved vehicle and highway design is illustrated by Figure 3. Four average speeds and the cumulative frequency distribution curve for each of these are shown. The results of nearly all speed studies conducted on tangent sections of main rural highways in 1941 during low traffic densities fell between curve A and curve B.

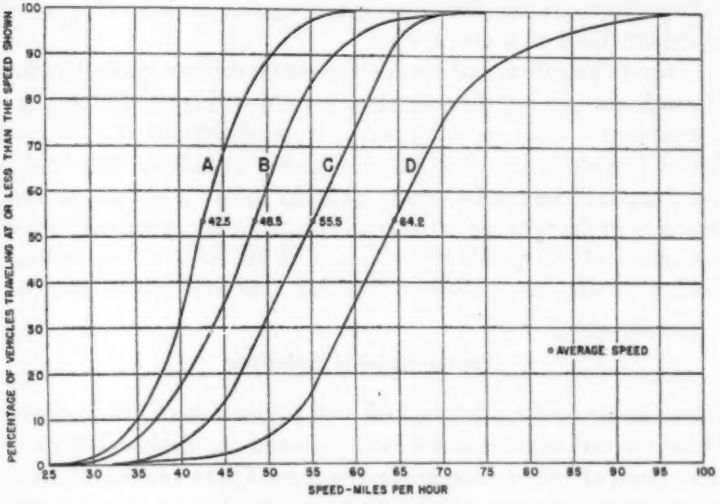


Figure 3. Distribution of normal passenger car speeds.

Speeds at the present time on modern rural highways generally fall between curve B and curve D of Figure 3. Curve B – which also represents the highest speed locations in 1941, including those with speed limits that were not enforced – is now exceeded on most modern highways except where a speed limit of 55 miles per hour, or less, is strictly enforced.

By comparing curves B and D, it will be noted that the top speeds have increased somewhat more than the lower speeds. The average difference of 16 miles per hour between curve B and D represents the change in driver behavior on rural highways through

improved vehicle and highway design over a 16-year period on highways where drivers were not influenced by speed limit restrictions. This is an average increase of one mile per hour per year, or about 1.6 miles per hour per year since the return in 1947 after World War II to the 1941 level.

Information of this kind is needed for the design of future highways, for traffic control and other traffic regulations, and to keep pace with changing conditions so that useful trends can be established in the prediction of tomorrow's highway requirements. Just as important, are the effects that speed regulation and traffic volume or density have on travel speeds.

It is obvious that, without speed control, drivers on rural sections of roads comprising the interstate system will immediately, upon completion of route sections, travel at speeds indicated by curve D during low densities. It is also reasonable to believe that vehicle-speed capabilities can be improved in the future to at least the same extent as in the past, with the result that average speeds of 80 miles per hour and top speeds above 100 miles per hour will be common during low densities wherever there is no enforced speed control.

Speed-Volume Relations

Other important considerations will affect future travel speeds. These include speed-volume relations and the desirability or obvious need of enforced speed regulations. There are few highways where speeds are not influenced by traffic density at some time; and in most areas, even on the most modern highways, speed limits are considered necessary to keep drivers within their performance abilities.

Curve C of Figure 3 shows a speed distribution typical of the most modern rural freeways having a well enforced 60-mile speed limit. The lowest speeds of this distribution are the same as those of curve D representing present speeds at a location with no enforcement, whereas the top speeds are no higher than those of curve B representing a much lower average speed.

Regardless of improvements in highway design, it is apparent that enforcement of speed limits will be required to prevent drivers from exceeding safe speeds as determined by their physical abilities and the performance of their vehicles. This is necessary because

vehicle-speed potentials continue to increase without a corresponding increase in other factors directly related to safety, such as friction coefficients and brake performance.

Since traffic volumes have increased at a much faster rate than it has been possible to construct new facilities, the percentage of time that highways are loaded to capacity or near-capacity volumes has increased. Speed-volume relations are therefore an increasingly important consideration in highway transportation,

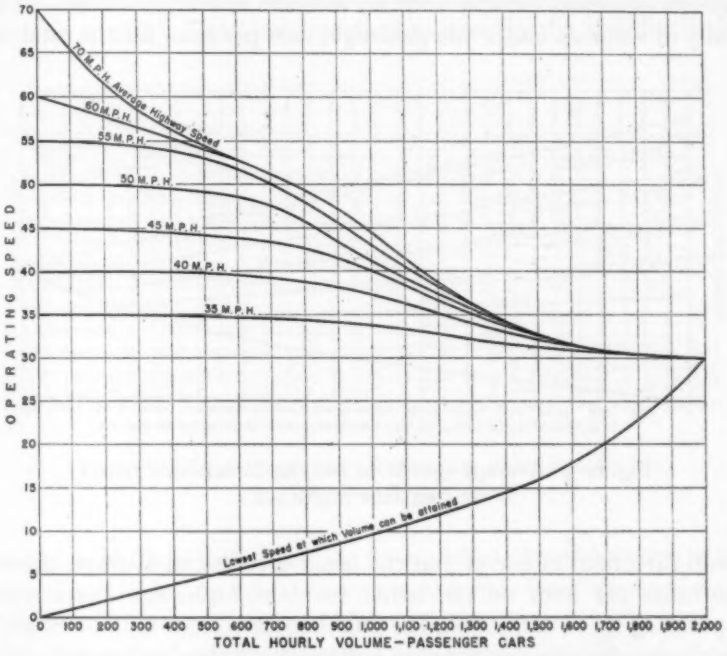

70 M.P.H. Average Highway Speed
60 M.P.H.
55 M.P.H.
50 M.P.H.
45 M.P.H.
40 M.P.H.
35 M.P.H.
Lowest Speed at which Volume can be attained
OPERATING SPEED
TOTAL HOURLY VOLUME—PASSENGER CARS
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70
0 100 200 300 400 500 600 700 800 900 1,000 1,100 1,200 1,300 1,400 1,500 1,600 1,700 1,800 1,900 2,000

Figure 4. Speed-volume relation for 2-lane highways.

including their application to traffic regulation and enforcement as well as to the design of new highway facilities. Figures 4, 5, and 6 show the relation between speed and hourly traffic volumes on two-lane and multi-lane highways under present conditions at locations removed from the influence of intersections and heavy merging movements.

Figure 4 shows the speed-volume relations for two-lane highways without passing sight-distance restrictions. The operating speed,

which is the highest over-all safe speed that drivers can travel under the prevailing traffic conditions, varies with the traffic volume and the highway speed. The highway speed, in fact, is the maximum safe over-all speed during low traffic volumes and varies with the stopping sight-distance, the sharpness and length of curves, and other geometric highway features.

From the curves of Figure 4 it may be seen that the ability of a good two-lane highway to accommodate traffic at today's desired speeds decreases rapidly with an increase in traffic volume. It is only at volumes under 700 passenger cars per hour for the total in

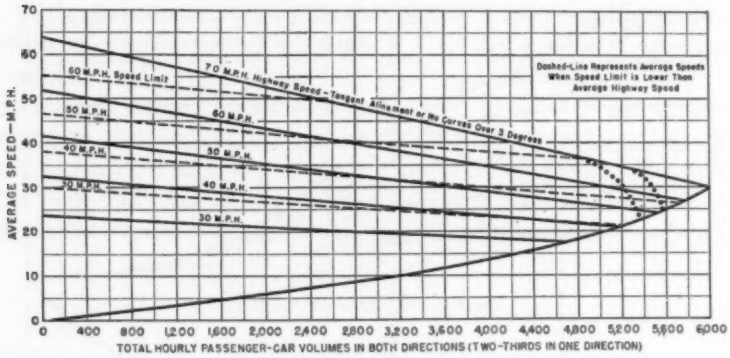

AVERAGE SPEED—M.P.H.
70
60
50
40
30
20
10
0
60 M.P.H. Speed Limit
70 M.P.H. Highway Speed - Tangent Alignment or No Curves Over 3 Degrees
50 M.P.H.
40 M.P.H.
30 M.P.H.
Dashed-Line Represents Average Speeds When Speed Limit is Lower Than Average Highway Speed
0 400 800 1,200 1,600 2,000 2,400 2,800 3,200 3,600 4,000 4,400 4,800 5,200 5,600 6,000
TOTAL HOURLY PASSENGER-CAR VOLUMES IN BOTH DIRECTIONS (TWO-THIRDS IN ONE DIRECTION)

Figure 5. Average speeds for heavier direction of travel on four-lane highways.

both directions of travel that the faster drivers can average above 50 miles per hour on the better two-lane highways. For a safe operating speed of 60 mph, the total hourly volume cannot exceed 250 passenger cars per hour – a low volume indeed compared with the peak volumes that most of the nation's important highways must accommodate.

Multilane highways are therefore necessary to accommodate the heavier traffic volumes at reasonable operating speeds. Figures 5 and 6 show the speed-volume relation for four-lane divided highways. Figure 5 shows average speeds while Figure 6 shows operating speeds or maximum safe speeds for drivers who desire to travel as fast as possible.

The bottom curves of Figures 4, 5, and 6 show the minimum speeds to attain a particular traffic volume. For example, traffic in the heavier direction of travel on a four-lane highway must be moving at least 20 miles per hour to accommodate 3,400 vehicles per hour in the heavier direction (⅔ of 5,100).

The other solid lines of Figures 5 and 6 show the normal operating speeds and average speeds, respectively, under different traffic-volume conditions for various highway speeds. These curves are also applicable to six- and eight-lane divided highways because studies made to date indicate that in general the speed-volume

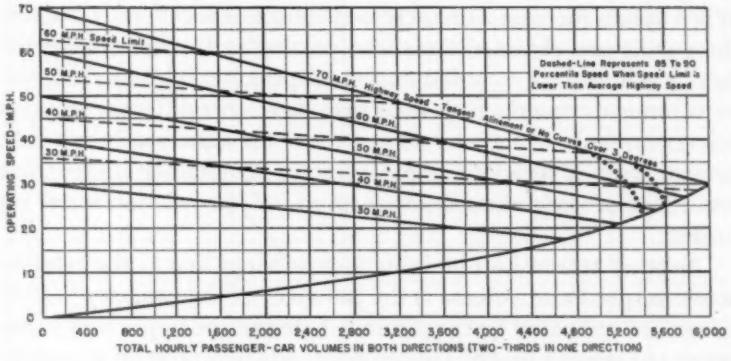

OPERATING SPEED - M.P.H.
70
60
50
40
30
20
10
0
60 M.P.H. Speed Limit
50 M.P.H.
40 M.P.H.
30 M.P.H.
70 M.P.H. Highway Speed - Tangent Alignment or No Curves Over 3 Degrees
60 M.P.H.
50 M.P.H.
40 M.P.H.
30 M.P.H.
Dashed-Line Represents 85 To 90 Percentile Speed When Speed Limit is Lower Than Average Highway Speed
0 400 800 1,200 1,600 2,000 2,400 2,800 3,200 3,600 4,000 4,400 4,800 5,200 5,600 6,000
TOTAL HOURLY PASSENGER-CAR VOLUMES IN BOTH DIRECTIONS (TWO-THIRDS IN ONE DIRECTION)

Figure 6. Operating speeds for heavier direction of travel on four-lane highways.

relation per lane is the same for six- and eight-lane highways as for four-lane highways where entrance and exit facilities do not influence the speeds.

The dashed lines of Figures 5 and 6 show the effect of an enforced speed limit on the speed-volume relation. A speed limit has an effect on safe speeds only when it is lower than the highway speed. Also, it has an effect only when the traffic volume is below the volume at which the dashed speed limit line intersects the line corresponding to the highway speed. At the higher volumes, the solid lines show the normal speed-volume relations, since at these volumes the speeds are governed by traffic densities rather than by speed limits. For example, a 60 mph speed limit on a 70 mph

divided four-lane highway would have no effect in the heavier direction of travel when the total volume exceeds 2,400 passenger cars per hour.

These speed-volume relations represent average conditions found on modern highways. In some areas, and under certain conditions, speeds are somewhat higher or lower than these charts indicate, but in general the differences are not great. Results of certain investigations show that on multilane highways only a very slight or no drop in speed occurs with an increase in volume.

This can be explained by the fact that a speed limit, or factors other than traffic density, exert a controlling influence on the speeds. When speeds increase with increased volume it is generally because the results are obtained from one particular location where the lighter volumes are recorded during off-peak periods and the heavier volumes during the rush-hour periods when a different group of drivers is involved, most of whom travel the same road each day. Several types of speed-volume curves can be obtained under these conditions of study since the true speed-volume relation is not recorded.

Another reason for obtaining a curvilinear line as the relation between speed and volume is the influence of the capacity "safety factor," as indicated by the distance between the upper and lower curves of Figures 5 and 6. This distance, which represents a possible speed range for a given volume, decreases rapidly as the volume approaches possible capacity. A slow driver or some other minor condition, interrupting the normal flow of traffic, can cause a sudden slowdown of all vehicles with the result that the speed-volume relation shifts from a point on one of the higher curves to a point on the bottom curve, or to any intermediate point. This is illustrated by the dotted lines on Figures 5 and 6. The closer the possible capacity is approached, the greater is the likelihood of such an occurrence.

Several factors other than highway speed and speed limit tend to affect the speed-volume relations. Those for which reasonably reliable data are available include the availability of passing-sections on two-lane roads, the width of traffic lanes, clearances to obstructions outside the traffic lanes, and the percentage of commercial vehicles. Their effects on operating speeds were included

in the "Highway Capacity Manual" but some changes in the effect of these factors will be made in the revised edition.[1]

As an example, the manual suggests that truck equivalents of two, four, and eight be applied in level, rolling, and mountainous terrain for multilane highways and that these equivalents be increased 25 percent for two-lane roads. More recent information

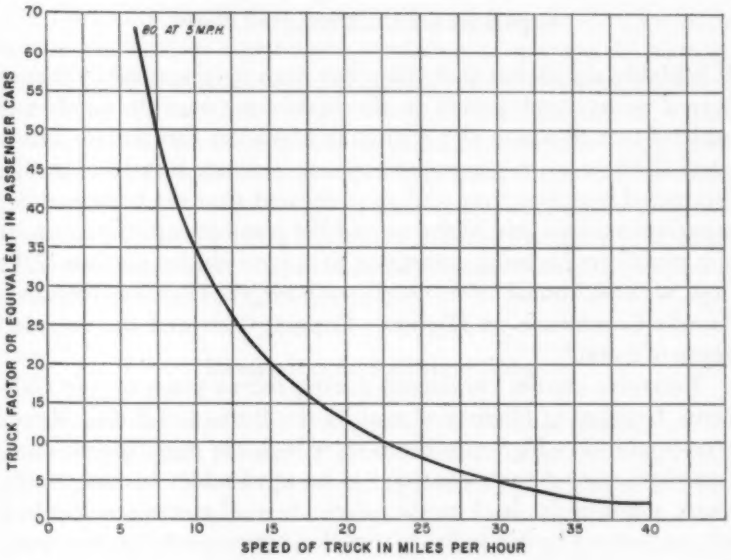


Figure 7. Truck factor for various average truck speeds.

shows that the truck equivalents on two-lane roads vary with the difference between the normal passenger car and truck speeds.

Figure 7 shows the variation in equivalents with truck speed for a given distribution of passenger car speeds (average of curves A and B, Figure 3). Figure 7 shows for example that a truck traveling 20 mph is equivalent, in a capacity sense, to thirteen passenger cars, regardless of the grade required to reduce the truck's speed to 20 mph. Similar curves can now be prepared for any two-lane highway when normal passenger car speeds are available.

1. *Highway Capacity Manual*, Highway Research Board, Washington, D.C. 1950.

The quantitative effect that trucks have on the capacity of multilane highways is not as well known, however, as for two-lane highways. It is entirely possible that a few heavy trucks on a long steep grade of a multilane highway might have as great an effect as a much larger number. Research is needed in this field to establish more reliable information than is presently available.

Capacities for Uninterrupted Flows

It is highly significant that there has been no measurable change over a twenty-year period in the maximum possible number of vehicles that two-lane and multilane highways can accommodate when the flow is not interrupted by intersections. Results of studies conducted between 1934 and 1941 showed that the total possible capacity of a two-lane highway and the possible capacity per lane of a multilane highway was 2,000 to 2,200 vehicles per hour.[2] In 1948, with additional information available, the Highway Research Board's Committee on Highway Capacity adopted the rounded figure of 2,000.[3]

Extensive studies conducted during recent years by the California Division of Highways[4] and by the Bureau of Public Roads in co-operation with a number of state highway departments show that these same figures continue to be applicable. In fact, traffic counts made as far back as the years when all passenger cars had only two-wheel brakes indicate that these same peak hourly capacities were attained at that time.[5] Some investigators using limited data have concluded that possible capacities are greatly in excess of these values but no such traffic volumes have ever been recorded.[6] [7] Vehicle headways, in terms of time, during peak volumes have remained unchanged despite the many improvements in vehicle performance during the last twenty years.

2. *Public Roads*, February 1939.
3. *Highway Capacity Manual*, Highway Research Board, 1950.
4. *Freeway Capacity Study*, 1956. George M. Webb and Karl Mackowitz. Highway Research Board Proceedings 1957.
5. Highway Research Board Proceedings 1931. Dean A. N. Johnson.
6. A study of traffic capacity by Bruce D. Greenshields. Highway Research Board Proceedings 1934.
7. Speed, headway and volume relationships on a freeway by T. W. Forbes, 1951 Proceedings I.T.E.

Even the skewed distribution of time-spacings between vehicles (c. to c.) has remained essentially unchanged for twenty years, with nearly half of the vehicles at less than half the average time-spacing and about two-thirds of the vehicles at less than the average time-spacing. One use of the headways or time-spacings between vehicles is to determine the relative road space that various classes of vehicles occupy.

In this connection, it is generally found that the average dual-tired truck occupies about twice as much road space as the average passenger car on a level section of highway. It is of interest, however, that under this condition about ten percent of the passenger cars are driven in such a manner that they occupy or use more road space capacitywise than the average dual-tired truck. Likewise, the small sport model cars may occupy a smaller parking space than the normal sized passenger car but on the road, when mixed with other traffic at high volume, they use somewhat more of the road capacity than the normal sized passenger car.[8]

Horsepower vs. Passing Ability

Everyone is familiar with the arguments for and against the increases made since the end of World War II in the horsepower of passenger cars. One of the advantages cited is the ability to complete passing maneuvers in less time, thus reducing the possibility of being caught in the left lane of a two-lane road with an oncoming vehicle rapidly reducing the time interval, sometimes between life and death. Closely allied with horsepower or acceleration ability, and perhaps equally important, is the lower height of the driver's eyes in the newer cars – a height that, under certain highway conditions, reduces the distance over which the driver can see a clear road ahead.

Many drivers have become sufficiently concerned with the change in these two characteristics of vehicle design to recommend that their effect as related to the present practices of marking no-passing zones on two-lane highways be investigated. A step has been taken in that direction.

Between 1938 and 1940 the Bureau of Public Roads conducted

8. Preliminary results from related studies underway by Bureau of Public Roads.

a comprehensive series of investigations of passing practices on two-lane highways. Detailed data were recorded for a total of 21,000 passing maneuvers at thirty-two locations in seven states. In looking for sites to observe present-day passing practices, it was found that at three of these old locations there had been no change since 1938 in the geometric highway features – surface width and condition, shoulder width, and sight distance conditions remained unchanged for nearly twenty years. Thus they were ideal locations to obtain a comparison of present passing practices with those in 1938 when cars had lower horsepower ratings.

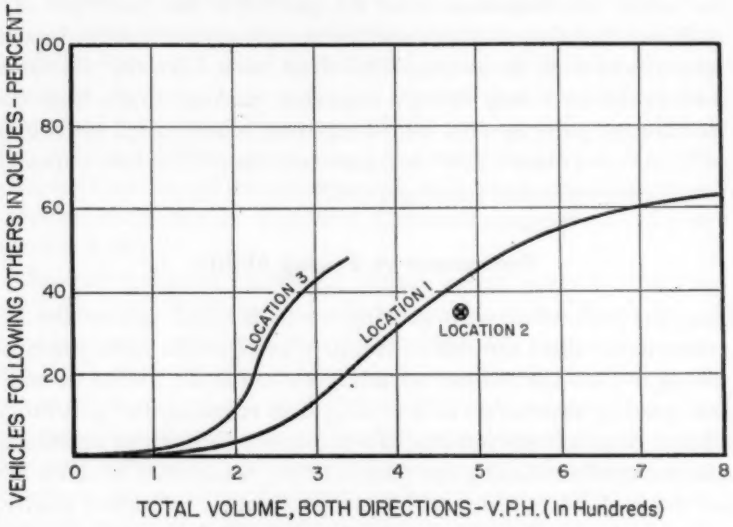


Figure 8. Restricted passing at three locations with varying sight distances.

Data were obtained during the recent studies by manual observation and were much less detailed than the 1938 records made with electromechanical equipment. Manual recording furnished sufficient information to reveal any marked change in passing practices over the nineteen-year period.

One study section had an 1,800-foot passing sight-distance between a horizontal and a vertical curve; the second had a 2,400-foot sight-distance between two vertical curves; and the third, a 3,300-

foot sight-distance between a vertical and a horizontal curve. Each was the best passing location for several miles.

The studies were scheduled so that traffic volumes and study periods were similar to those for which data were recorded in 1938.

There was a high demand on all sections for passing maneuvers as measured by the percentage of vehicles following other vehicles at short headways in a queue of two or more vehicles as if anticipating an opportunity to pass. Figure 8. At location 1, the studies were conducted under a wide range of traffic volumes. The percentage of vehicles in queues being restricted in speed increased with an increase in traffic volume. At location 2, the traffic volume was constant during the study on three different days. Location 3, with the longest sight-distance, had the highest percentage of vehicles traveling in queues at low traffic volumes because sight-distances sufficient for passing were less frequent than on the other two.

Figure 9 shows the number of passings accomplished per hour on the three sections during various hourly volumes, in 1938 and 1957. On section 1, with the shortest passing sight-distance, less than one-third as many passings were accomplished during the 1957 studies as during the 1938 studies at similar traffic volumes. At the second location, with the intermediate sight-distance, 39 passings per hour were performed in 1957 as compared with 52 in 1938 at the same traffic volume. At the third location, with the longest sight-distance, more than twice as many passings were performed per hour in 1957 as in 1938 with similar traffic volumes.

Drivers are now apparently more reluctant to undertake a passing maneuver on shorter sight-distance sections and less reluctant on longer sight-distance sections than drivers in 1938. Drivers today are perhaps more cautious or have a better understanding of the danger involved in performing passing maneuvers at short sight-distances, despite the increased horsepower of their vehicles, than drivers in 1938. But such conclusion is unwarranted by these limited studies.

Table I compares numerically the results of the 1938 and 1957 studies.

Detailed data were obtained for 608 passing maneuvers in 1938 and for 476 in 1957. The 1957 data were separated into two groups, one including passing maneuvers by 1954-model or older vehicles;

the other including 1955, 1956, and 1957 models. The break was made between the 1954 and 1955 models because between these two years most automobile manufacturers made the greatest increase in horsepower.

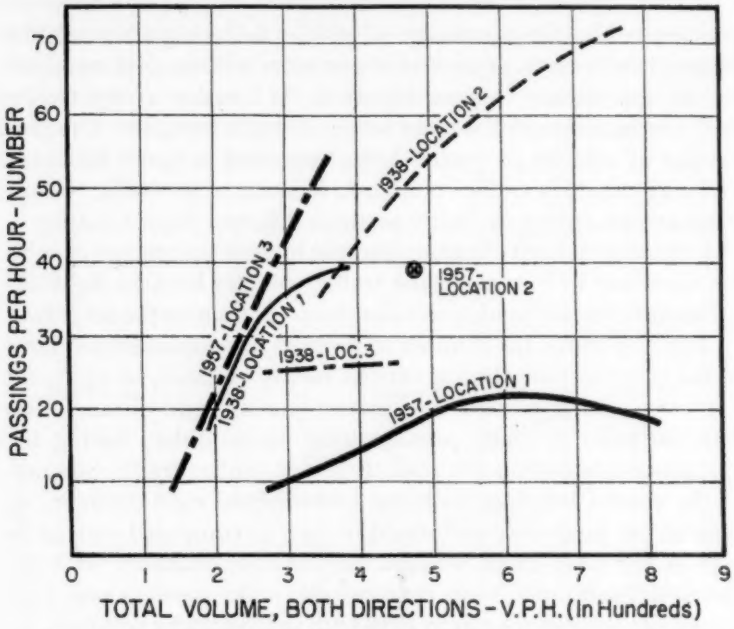


Figure 9. Number of passings per hour in 1938 and 1957 studies.

From 1938 through 1954 there were periodic increases in the horsepower of practically all makes which, over the years for some of them, totaled considerably more than the 1954–1955 increase. It seemed desirable to divide the 1957 study data into two groups, particularly since the one group thus includes only "new" vehicles – those less than two-and-a-half to three years old.

Passing Practices Show Little Change

Speeds of both passed and passing vehicles were higher in 1957 than in 1938. The passed vehicles in 1957 were moving three to four miles per hour faster than in 1938, and speeds of passing vehicles were six

Table I

COMPARISON OF PASSING PRACTICES IN 1938 AND 1957

Study section	1938 study	1957 study	
	all models	1954 and older models	1955–57 models
	Number of passings studied		
1	130	46	90
2	245	69	139
3	233	45	87
Total . . .	608	160	316
	Average speed of passed vehicles—m.p.h.		
1	34	34	36
2	35	38	39
3	36	42	42
Average . .	35	38	39
	Average speed of passing vehicles while in left-hand lane—m.p.h.		
1	44	48	50
2	45	51	50
3	46	54	56
Average . .	45	51	52
	Average time passing vehicles were in left-hand lane—seconds		
1	11.4	9.0	9.0
2	9.0	9.3	9.0
3	10.1	11.9	11.1
Average . .	10.2	10.1	9.7
	Average distance passing vehicles were in left-hand lane—feet		
1	740	630	650
2	540	700	660
3	640	950	910
Average . .	640	760	740
	Average speed of free moving vehicles—m.p.h.		
1	42	44	
2	41	42	
3	40	49	
Average . .	41	45	

to seven miles per hour higher. The average speed of vehicles unobstructed by a vehicle ahead was five miles per hour higher in 1957 than in 1938. The average difference between the speed of passed vehicles and the speed of passing vehicles, during the maneuver, was ten miles per hour in 1938 and thirteen in 1957, as shown in Table I.

Time spent in the left-hand lane by the newer vehicles in 1957 was 0.5 second shorter than in 1938. The distance traveled in the left lane, however, increased 100 feet. Thus it would appear that increasing the average horsepower, from 1938 to 1956, by about 75 percent has decreased the time needed to pass by about five percent, but has resulted in an increase of the distance traveled in the left lane by about 19 percent.

This finding obviously is not in accordance with what might have been expected and illustrates the importance of research, for inquiry into the manner in which people operate their vehicles must be based on careful study of actual performance rather than on speculation or assumed driving practices.

From the most carefully planned and executed studies, average values may be misleading. More important in connection with passing maneuvers may be a driver's ability to accelerate his vehicle quickly and get out of a tight spot.Table II shows the shortest time intervals and the average for the ten percent of passing maneuvers made most rapidly. Values are included for two types of passing maneuvers – "delayed starts" and "flying starts."

Delayed starts include maneuvers by vehicles that had slowed down to the approximate speed of the vehicle to be passed prior to entering the left lane. Flying starts include maneuvers by vehicles that entered the left lane at a speed considerably higher than the speed of the vehicle to be passed. There is no consistent difference between the 1938 and 1957 values for either of these groups, and the significance of the figures is obscure. In general the new vehicles were in the left lane a slightly shorter time than in 1938, but the time for the fastest maneuvers has not changed.

Similar information for maneuvers in which passing vehicles occupied the left lane for shorter distances indicates approximately the same relative difference between the 1938 and 1957 data as the average values, Table III.

Table II

MINIMUM TIME THAT PASSING VEHICLES OCCUPIED LEFT-HAND LANE

Study section	Delayed start			Flying start		
	1938 study	1957 study		1938 study	1957 study	
	all models	1954 and older models	1955–57 models	all models	1954 and older models	1955–57 models
	Minimum time					
	Seconds	Seconds	Seconds	Seconds	Seconds	Seconds
1	5.6	4.0	4.5	5.5	5.0	4.0
2	4.3	4.5	4.0	3.8	3.0	4.0
3	4.6	5.0	6.0	4.1	5.0	5.2
Average	4.8	4.5	4.8	4.5	4.3	4.4
	Average time for 10 percent of the passings made in the shortest time					
1	7.6	5.0	5.0	6.9	5.0	5.9
2	5.1	5.9	5.2	4.6	5.6	5.2
3	5.8	5.8	6.4	4.9	6.2	6.6
Average	6.2	5.8	5.5	5.5	5.6	5.9

Table III

SHORTEST DISTANCE THAT PASSING VEHICLES TRAVELED IN LEFT-HAND LANE

Study section	Delayed start			Flying start		
	1938 study	1957 study		1938 study	1957 study	
	all models	1954 and older models	1955–57 models	all models	1954 and older models	1955–57 models
	Minimum distance					
	Feet	Feet	Feet	Feet	Feet	Feet
1	300	340	370	350	350	300
2	170	290	200	170	150	500
3	310	300	450	260	250	430
Average	260	310	340	260	250	410
	Average distance for 10 percent of the passings made in the shortest distance					
1	450	380	430	450	410	490
2	320	460	310	240	480	530
3	370	420	550	360	400	510
Average	380	420	430	350	430	510

Since no accidents occurred at these three locations during either the 1938 or 1957 studies, and accident data that relate horsepower to accidents during passing maneuvers are not available, the accident potential of increased horsepower must be measured by the percentage of maneuvers completed shortly before meeting an oncoming vehicle or after reaching the no-passing zones. Table IV shows the percentage of passing maneuvers of this type.

When the distance is less than 200 feet between two vehicles traveling toward each other at 50 miles per hour on a two-lane highway, they will meet in about 1.4 seconds. Two and one-half percent of the passing maneuvers studied in 1938, and one-half of one percent of those studied in 1957 involving the newer group of cars, were completed with oncoming vehicles less than 200 feet away. This is a significant difference.

Figures for the other items shown in Table IV are also lower for late model cars observed during the 1957 studies than for the 1938 studies. Whether or not horsepower ratings had anything to do with these results has not been determined. Driver training and a variety of other factors may have had a more pronounced effect than the vehicle horsepower. Certainly, the new-car drivers in 1957 were taking fewer chances.

Research in Intersection Capacities

In an entirely different field of traffic-capacity research, the change in intersection capacities is an illustration of the need for keeping abreast of changing traffic conditions. In 1946, through the cooperation of members of the Institute of Traffic Engineers and highway officials throughout the country, it was possible to obtain data and complete an analysis of intersection capacities.

For the first time, reasonably reliable data were obtained for intersection design and for predetermining both quantitatively and qualitatively the resulting increases in street capacities by eliminating parking, eliminating right or left turns, providing one-way street systems, widening streets, and many other possible traffic control and construction improvements. These data afforded a much-needed tool for the highway and traffic engineering professions.

But tools become dull with use and obsolete if not improved. During the last two years, with the help of many of the same organizations, data for some 1,200 congested intersection locations were obtained for analysis. This number is more than four times the number available in the previous analysis, and the data for each of these are far more comprehensive and possibly somewhat more accurate.

Table IV

PERCENTAGE OF PASSING MANEUVERS COMPLETED WITH SHORT DISTANCES TO ONCOMING VEHICLES OR AT POINTS WHERE SIGHT DISTANCES WERE SHORT

	1938 study	*1957 study*	
Study section	*all models*	*1954 and older models*	*1955–57 models*
	Oncoming vehicle less than 200 feet away		
	Percentage of passing maneuvers		
1	1.5	6.5	0
2	3.7	1.5	1.4
3	2.2	2.2	0
Average	2.5	3.4	0.5
	Oncoming vehicle less than 300 feet away		
1	4.7	8.7	5.6
2	9.8	3.0	5.1
3	5.2	2.2	0
Average	6.6	4.6	3.6
	Sight distance less than 300 feet		
1	5.4	0	0
2	4.1	1.4	0.7
3	0.9	0	0
Average	3.5	0.5	0.2
	Sight distance less than 600 feet		
1	29.3	26.1	22.2
2	11.5	8.6	12.2
3	5.6	11.1	2.3
Average	15.5	15.3	12.2

The analysis – which involves forty-five different variables – is now underway by employing electronic computer techniques. Prior to starting the analysis, much work was done by the supervisor to obtain the parameters of the many variables and some preliminary results. The final results may modify the entire approach to the analysis of intersection capacities. Based on an approach similar to

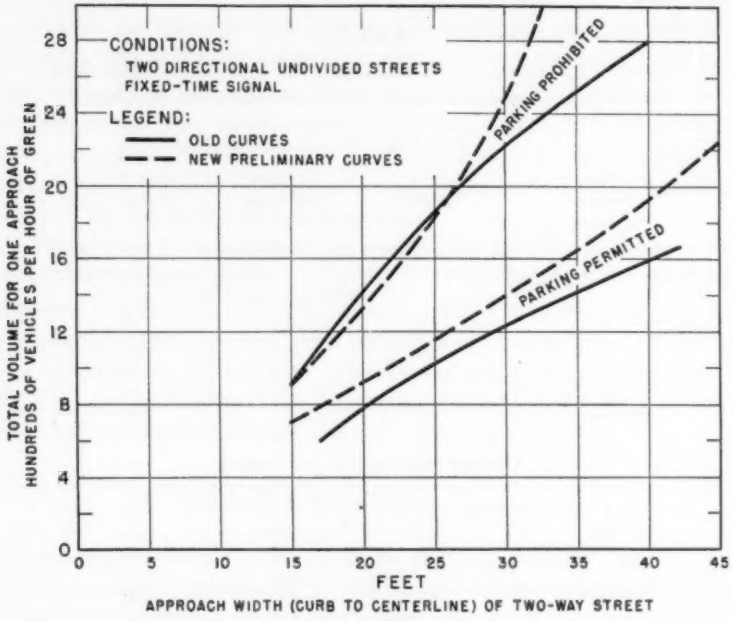


Figure 10. Average intersection capacities of downtown two-way streets.

the one used in the 1950 manual, it has been possible to show pertinent changes in intersection capacities during the last ten years.

In general there has been a substantial increase in intersection capacities – a fortunate trend that has done much to keep traffic conditions from becoming progressively worse at a much faster rate. The most pronounced increase has taken place on the wider streets.

Figure 10 shows a comparison of 1946 and present capacities of intersections on two-way streets in downtown areas by street widths. The dotted lines, representing present conditions, curve in one

direction while the solid lines, representing conditions about ten years ago, curve in the other direction. The wider streets which, on an average, were less efficient per foot of width than the narrower streets, are now more efficient per foot of width. A similar change has occurred at intersections in other areas of the cities in which data were recorded.

What brought about these increased intersection capacities, particularly of the wider streets? Changes in vehicle design to improve performance and ease of operation have no doubt had a substantial effect; but it is believed that most of the increase has resulted from the application of improved traffic control techniques and regulations – separate right and left turn lanes, better enforcement of parking regulations, and the development and proper use of improved traffic control equipment.

Wider streets have shown a greater increase in capacity than narrower streets because their potential capacities, until recently, were not fully realized. The "know-how" of dealing with large volumes of traffic on city streets and with individual drivers that seriously impede traffic flow has also improved.

What would traffic conditions be today if there had been no improvement in traffic control practices, and street capacities had remained as reported by Mr. Hawley S. Simpson in his award-winning paper before the ASCE in 1934? At that time he found that a second lane in each direction added 78 percent to a street's capacity, the third lane added an additional 56 percent, the fourth lane added 26 percent, and the fifth lane added nothing. Three lanes in each direction were only 78 percent as efficient per lane as a single lane in each direction. The corresponding figure today on city streets is about 115 percent. Likewise, in rural areas, one four-lane divided highway will accommodate three to five times as much traffic as a two-lane highway – and with a lower accident rate.

A preliminary look at results being obtained by the current analysis of intersections with fixed time signals is presented in Figures 11 and 12. These are average values for various types of streets, with about half the streets accommodating more traffic and half of them less traffic than indicated by the curves. Upon completion of the analysis, it is expected that far more will be known regarding reasons for variation in intersection capacities than has

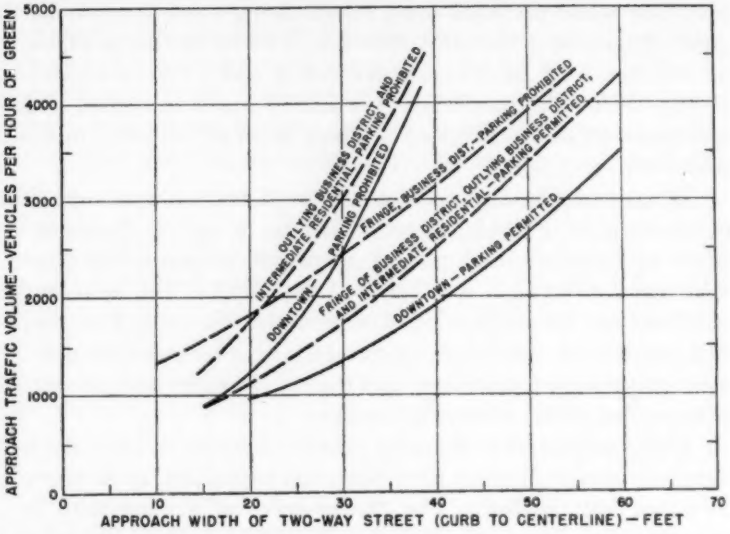


Figure 11. Intersection capacities of two-way streets fixed-time signals.

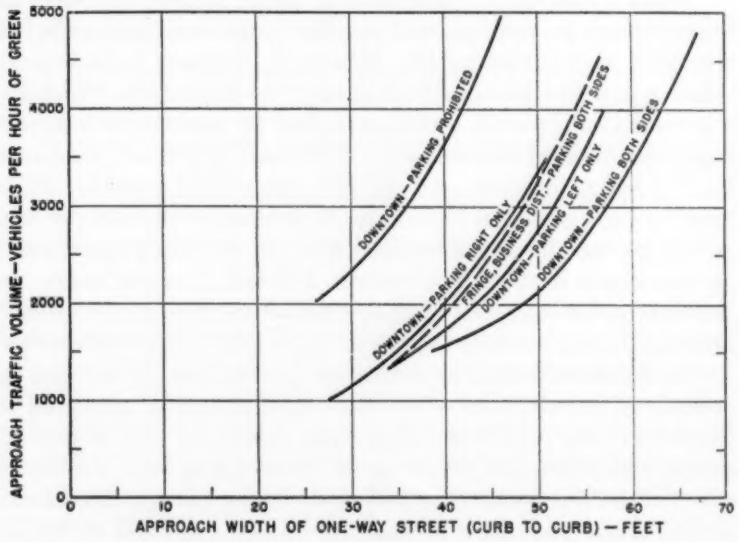


Figure 12. Intersection capacities of one-way streets fixed-time signals.

been known in the past. It is expected that it will be possible to establish reliable factors for many of the forty-five different variables. The effect of the more important ones now covered in the present manual – turning movements, commercial vehicles, and bus stops – and many others not now included will be accurately determined from the large volume of data available.

Great Improvement Possible Through Research

Completion of this analysis should, however, be only the beginning of a determined effort to improve traffic on city streets through research. With a better knowledge of the effect of the many factors involved and availability of electronic computers, improvement of traffic conditions on a street system throughout a large metropolitan area by simulation and electronic control can then become a reality rather than a highly theoretical approach based largely on unverified assumptions.

Ranking high in a priority program of needed additional information for use with simulation techniques will be the change in length with time and distance of queues of vehicles as they pass through one intersection and approach the next intersection.[9] In my opinion, little is gained by simulating traffic conditions at an individual location over and above that now possible by other more direct methods. Simulation will, however, soon become a most important tool for co-ordinating the traffic flow on entire street systems and between systems.

It is almost pathetic how little is really known about the efficiency or inefficiency at which our existing traffic facilities are being operated. This is not the fault of the traffic engineering profession. Rather it is caused by insufficient research to develop improved methods. Time-space diagrams for establishing progressive movement on an interconnected signal system, for example, are entirely inadequate for the purpose they are intended to serve. They continue to be used only because improved methods that take into consideration several important factors other than time and distance have not been developed despite their great need.

9. "The Platoon Movement of Traffic from an Isolated Signalized Intersection," by Bryan J. Lewis. Bulletin No. 178 Highway Research Board.

The rapidly increasing mileage of freeways has already made it apparent that improved and new techniques are required to maintain a smooth and safe flow of traffic, especially in the vicinity of interchanges where heavy volumes leave and enter the freeways. In this connection, some engineers tend to believe that each interchange will cause some degree of interruption to freeway traffic, and that a minimum distance – one-half mile, one mile, or two miles – should be spaced between interchanges to obtain proper traffic operation. Both of these beliefs are true to the extent that it has generally been at, or in the vicinity of, ramp exits and entrances that the greatest congestion has occurred on existing freeways.

If properly designed for the volumes that will use them, ramp entrances and exits need not impede the smooth and safe flow of traffic on the freeway. Likewise, the best spacing of interchanges will vary with specific traffic conditions. In some areas, greater frequency with less traffic per ramp will affect freeway traffic less than fewer ramps with heavier traffic volumes. In some cases a definite improvement has resulted by constructing two ramps closely spaced to handle a volume originally intended for one ramp. Desirable operating conditions must, therefore, be attained by proper design for existing and future conditions, rather than by adoption of minimum spacing of interchanges or ramps in rural or urban areas.

Inadequate merging and weaving distances, or failure of the designer to recognize the existence of a weaving area in his layout have been the two principal causes of congestion observed on existing freeways – excluding overloaded facilities and abnormal conditions from accidents and vehicle breakdowns.

An inadequate merging distance will increase the accident potential, cause traffic slowdowns, and reduce the capacity of freeway through-lanes. Whenever a highly congested condition with stop-and-go operation occurs on a freeway in the vicinity of an entrance ramp or at the connection with another roadway, and the traffic on the section beyond the ramp averages less than 2,000 passenger cars per lane (or the equivalent mixed traffic), the cause of congestion can generally be attributed to an inadequate merging distance or a design that does not encourage drivers to use the available merging distance.

On some freeways, inadequate merging distances have cut the "going away" volume or number of vehicles leaving such a location from 2,000 to 1,700 – sometimes to 1,400 – passenger cars per lane per hour. This lag occurs on freeways that at other locations sometimes accommodate peak volumes in excess of 2,000 vehicles per lane.

Freeways are generally designed for practical capacities well below 2,000 vehicles per hour per lane in order to provide reasonable operating speeds. It is believed, however, that ramps, weaving areas, and other facilities that influence the capacity of main roadways should be designed so that main roadways can accommodate 2,000 vehicles per lane per hour. Unless this is done, main roadways will not accommodate their design volumes at desired speeds, nor will they carry infrequent overloads without extreme congestion.

After a freeway has been designed for a practical capacity of 1,000 to 1,500 vehicles per lane, depending upon desired operating speeds during the design hour, the design should be checked to determine whether the road has a possible capacity of 2,000 vehicles per hour per lane. Usually such a check will reveal that relatively minor changes are required in acceleration-lane lengths and in the design of weaving sections. This procedure seems reasonable in view of the uncertainty in predicting future traffic volumes and the difficulty of making even minor changes once a freeway is in operation.

Extensive studies are now under way to determine the effect of ramp design on traffic capacities and the resulting influence on freeway traffic. These studies will be continued as additional freeways are completed and new designs are loaded with traffic approaching capacity volumes. Much needs to be learned before terminals of entrance and exit ramps can be designed on a more scientific basis with the assurance that traffic will use these areas – including acceleration and deceleration lanes – as intended by the designer.

Weaving Area Capacities Have Improved

Traffic behavior at weaving areas is closely allied with entrance and exit ramps since weaving maneuvers are generated by the need of one traffic stream to cross another traffic stream using a different entrance and exit. A merging maneuver required at the entrance

terminal of a ramp is also similar to the type of merging maneuver required during an early stage of a weaving maneuver.

Results of recent investigations to determine operating capacities of weaving sections are shown by Figure 13. A comparison of this figure with a similar one in the 1950 Highway Capacity Manual shows that over a ten-year period the possible capacities of weaving sections have substantially increased. The top curve still starts at 1,400 maneuvers per hour for the shortest length possible, but is 20 percent higher than the old curve for a section 1,000 feet long.

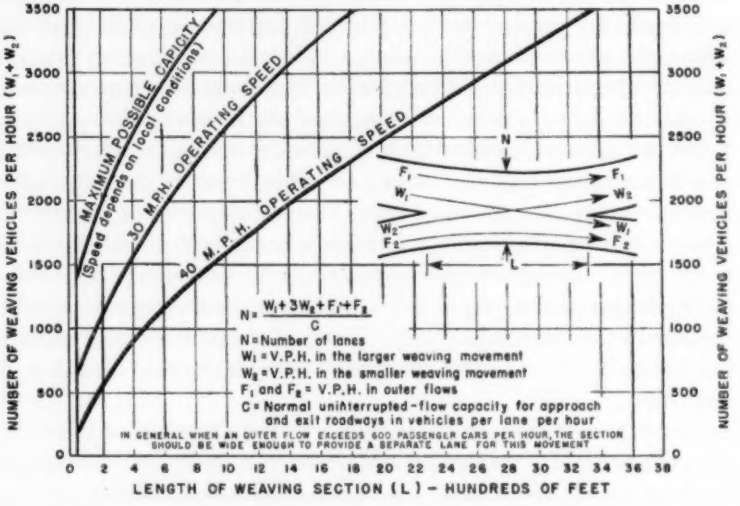

NUMBER OF WEAVING VEHICLES PER HOUR (W_1+W_2)
MAXIMUM POSSIBLE CAPACITY (Speed depends on local conditions)
30 M.P.H. OPERATING SPEED
40 M.P.H. OPERATING SPEED
$N = \frac{W_1 + 3W_2 + F_1 + F_2}{C}$
N = Number of lanes
W_1 = V.P.H. in the larger weaving movement
W_2 = V.P.H. in the smaller weaving movement
F_1 and F_2 = V.P.H. in outer flows
C = Normal uninterrupted-flow capacity for approach and exit roadways in vehicles per lane per hour
IN GENERAL WHEN AN OUTER FLOW EXCEEDS 600 PASSENGER CARS PER HOUR, THE SECTION SHOULD BE WIDE ENOUGH TO PROVIDE A SEPARATE LANE FOR THIS MOVEMENT
LENGTH OF WEAVING SECTION (L) – HUNDREDS OF FEET

Figure 13. Operating characteristics of weaving sections.

There has also been some increase for the 30 mph operating speed, but no apparent change for the higher operating speed of 40 mph.

It should always be kept in mind when using Figure 13 that it was prepared for design purposes and for that reason shows traffic capacities that can be attained or exceeded at most locations. The length, width, and capacity of a section are interrelated to the extent that several combinations of length and width can be used for a given traffic condition.

The values obtained from Figure 13 will result in a balanced design within a minimum length. When longer-than-minimum

lengths are available, reductions in the total width can be made in accordance with a recent article published by the Highway Research Board.[10] This article also explains other considerations that apply to weaving sections.

Traffic engineering is a dynamic field dealing with ever-changing conditions. The trend toward construction of freeways in both rural and urban areas in an effort to solve some of our worst traffic problems is a result of these changing conditions. Comparatively few modern freeways have been placed in operation in urban areas, but it is already apparent that new techniques and operational skills are required to maintain a smooth, safe flow of traffic, especially in the vicinity of interchanges where heavy volumes leave and enter the freeways. Through research, basic principles of traffic flow can be developed that may make our present methods appear as obsolete tomorrow as a 1930 automobile does today.

Closed circuit television for scanning trouble spots, radar detection, and the use of high speed computers in traffic control as well as for simulating traffic conditions in solving complex problems will soon become everyday tools of traffic engineers. The full benefit of these developments will be realized, however, only by following Ted Matson's example – constant search for new knowledge.

10. "Operation of Weaving Areas," Page 38, Highway Research Board Bulletin Number 167, January 1957.

Idealism in Our Highways

CARL E. FRITTS

Mr. Fritts, a civil engineer, has been with the Automotive Safety Foundation since 1946. Previously, he was for twenty years with the Washington State Highway Department. He also was a traffic engineer with the Highway Traffic Advisory Committee to the War Department. In the ASF, he served in positions from highway engineer to vice president in charge of engineering. The highways division in this period has participated in twenty-eight highway engineering studies in twenty-two states and the Province of Ontario.

AFTER forty years of experience in developing highways by the federal government, states and local governments, the nation finds its highway program grossly inadequate on many segments. In spite of larger investment of public funds, the nation still lacks the benefits obtainable from a higher level of transportation.

What are future prospects? How close can we come to idealism in terms of economy, safety, and pleasant travel?

Evidence predicts that the next decade will be outstanding in highway history. It could well be in that period the effort will close to a small margin the gap between highway demand and highway need. If we near the point of maximum benefit through highway transportation, our productive efforts must be continued at current high levels and increased as the program goes ahead.

The all-time demand for highway engineering services is pushing engineering departments to maximum effort in plan and program development. They are preparing designs for modern, free-flowing arteries of travel. Departments are supplementing their own forces with private engineering firms. Modern mechanical devices speed up engineering processes, adding to their means of comparative evaluation of the problems of location and design.

Material Demands Can Be Met

For a time, some segments were unable to provide necessary materials to keep the highway program at desirable levels. Today, important industries in highway improvement are geared to the

accelerated program of highway engineers. All demands for materials and equipment can be met on schedule with sufficient competition to keep costs reasonable.

In the last few years, most states have provided increased funds for highway purposes. There now is indication that capital improvement will come closer to desirability than in the past. However, some states still have been unable to balance needs and finance. In those instances, study will be required. As other states advance their modernization plans, laggard states will realize the losses from inadequate treatment of the highway plant.

The stimulation to increased highway development on a nationwide basis by the federal-aid Act of 1956 is positive evidence that public officials and legislators recognized the inadequacy of past programs. The new level of transportation service that will be provided by the National System of Interstate and Defense Highways will give new meaning to values inherent in modern highway movement. The principles of design for creating freedom and safety of movement will extend ultimately to many miles of facilities not a part of the interstate system.

Urban Transportation Planning Stimulated

The national highway program has provided a universal stimulus to urban transportation planning. A few metropolitan areas previously were under way with construction of modern urban highway facilities prior to 1956. Some had master plans – many did not. Today, all are in some stage of the development of a highway program.

Many are striving to capitalize to the fullest extent possible on the benefits of the coming highway program. Efforts are being made to integrate a free-flowing urban freeway network with the complex elements of the urban compact. Urban areas are expanding rapidly, with increases in population and transportation demands growing proportionally. Cities are undergoing changes in land use character. Transportation will be a key element in the redevelopment of the future. New relationships will become a reality in urban areas in the next ten years.

Important as the interstate system and urban arterial systems

are in terms of high volumes of traffic movements, the great function of the primary and secondary systems must not be overlooked. Mines, forests, farms, small and medium size cities, and recreation – all are dependent on adequate highway service. Thus, the highway program must include development of this vast mileage of roads if benefits are to be equally shared. The federal-aid program recognizes this principle and encourages states to keep their systems in reasonable balance by a continuing program of financial support. States are doing this either by assuming full responsibility or by financial aid to local governments for highway purposes.

We have reached a period of great momentum in the goal of obtaining adequate highway service. We have attained a high level of understanding of the need and the benefits, and have responded by much greater financial support for the improved plant. However, we are far from the state of idealism at this point.

Optimum Highway Development Defined

First, what would we accomplish with an optimum highway program?

The program would serve economic and social growth by putting streets and roads in a condition permitting movement by all motor vehicles at lowest operating cost, maximum operating speed, and with highest degree of safety. All of these objectives must take full account of the economics involved. There is a point at which the cost of highway improvement cannot be justified. In other words, highways could be so over-designed that costs involved would exceed the direct and indirect benefits.

Design standards in use as guides for highway improvements on many classes of roads and streets reflect the engineers' concept of a proper balance between cost and service benefits.

These concepts have evolved from a great many years of study and experience. They are backed by numerous economic studies, yet we are unable to evaluate fully the many intangible benefits resulting from highway transportation.

Savings from reduced vehicle operating costs, for example, are fairly well defined. Saved time can be evaluated. Benefits that accrue to communities at large, to recreational and social activities,

and to properties generally, are not so firmly established. Yet positive evidence of real value is found in the public demand for adequate facilities, and its willingness to pay for these benefits.

The highway plant would be at an optimum point if all roads and streets were improved to standards adopted by the engineering agencies, such as the American Association of State Highway Officials and the U. S. Bureau of Public Roads. Comparable standards are adopted by many cities and counties as their concept of the optimum highway plant. These standards provide practical means of determining the status of highways, and they provide a sound basis for orderly and economical program control for the future.

Orderly Scheduling Essential

Highway improvement requires an orderly scheduling of events if highest values are to be achieved without destructive effects. Major revisions should be accomplished without restricting the present movement of persons and goods and with the minimum effect on business, the housing of people, and schedules of educational, social or recreational programs. To accomplish this, care and judgment must be used to develop a sequence of highway improvements.

Moreover, highway improvements should be scheduled in an order to bring the greatest return on the investments. In that way, highway developments – like other good capital expenditure – provide the highest dividend. For very practical reasons, this principle may not always be controlling.

A highway, for example, may be rendering near-optimum service in all aspects but one – the surface has reached a state of near-disintegration. Obviously, such a route must be improved soon, or all transportation would be lost because of complete failure of its load-carrying ability.

In general, the highway administrator must recognize all of the influencing factors as guides in the program of improvements which are his responsibility.

The average administrator is preparing his yearly programs under conditions which are far different from those that would exist if the highway systems were now at optimum development. Mostly, it is a job of eliminating the worst evils of many. In other words,

the backlog of deficient or sub-standard sections of roads and streets is so great that his problem becomes one of selecting out of a long list of needed improvements, a grouping of those *most* needed – those that are most justifiable from many that are warranted.

Fundamentals Required

The engineering of orderly highway development requires certain fundamental operations. First is an evaluation of the needs of the systems. Such studies must show where and why each system is deficient, the degree of deficiency, and what a proper improvement will cost. The second fundamental is a fiscal forecast which gives the administrator the opportunity to schedule improvements within an assured financial framework. It is the ratio of finance to highway costs which determines program time and rate.

Of course, highway improvement can be done by simply building any projects that can be financed with current revenue. However, building without knowledge of the effect of such work on the total needs would seem to fall considerably short of good management. When programs are prepared on the basis of their effect upon the long-term needs, decisions can result in greater over-all benefits.

It is difficult to visualize complete competency in program preparation, when the programmer cannot ascertain whether his planning is going to gain ground in the final goal of an adequate system. Frequently the problem is to program funds between several systems; when that is the case, it is most difficult to achieve equity of balance in the rate of improvement without the fundamental base of a comprehensive survey of the long-range needs of each system.

One of the serious problems of the past has been lack of knowledge of the needs in urban areas. Because of the absence of enough engineering facts, urban programs have been retarded. Funds have been programmed in rural areas instead, where the problem has been more simple and where facts were generally available. The program of the future must have a proper balance between rural and urban improvement if we are to gain real ground in the struggle for transportation adequacy.

The majority of the states are reasonably well equipped to program their funds in an orderly manner. They have the basic facts which give them an evaluation of system needs in all areas. They

know how much should be done on primary arteries and secondary facilities in both rural and urban areas.

Thus, they are able to balance the capital expenditure program in direct proportion to need. Under the stimulus provided by the 1956 federal-aid Act, each state now has evaluated needs of all systems. While these studies were designed primarily for the purpose of cost responsibility in highway finance policy, needs estimates become most useful data for balancing highway programs.

Balanced Fiscal Policy Needed

The most common handicap to be overcome is a balanced and continuing highway fiscal policy. Without finances properly allocated to systems on a basis of relative need, the program of improvement is obviously bound to bring about distortions of service.

In many states, legislative fiscal policies of the past have forced predominantly rural highway programs, and cities have, as a result, reached a state of near complete congestion. Other states occasionally have adopted fiscal plans which forced a rapid development of secondary or feeder roads, while the primary routes were allowed to depreciate under heavy movements of persons and goods.

Some states still operate on a fiscal policy which makes the highway program contingent on annual or biennial appropriations, with no continuing assurance to the highway administrator of the amount available for advance programming. The highway development of today requires not only an adequate level of financial support, but an assured continuity. Many of the complex facilities needed in urbanized areas take several years to put into service. Once the designs are set, much time is needed to acquire rights of way, clear properties in an equitable manner, and to actually construct roadways and structures.

And in the economical conduct of the future program, there is need to acquire, well in advance, rights of way in the expanding urban areas before they are covered with new housing and commercial buildings. The administrator lacking assurance of a stable fiscal plan is seriously handicapped in devising a program which creates maximum service at the lowest possible cost.

The federal-aid program is an important force guiding the development of our highway systems. By specific allocations to the

interstate, primary and secondary systems and urban extensions, many states' programs are guided in some instances, or even dictated, through assignment of matching funds. Except in those states where highway funds are in excess of the matching funds required, federal-aid funds become the major program controls. With the exception of the interstate system, federal-aid allotments are not made on a basis of relative needs, but on a formula deemed by Congress to be equitable.

If the systems of each state are to be developed properly on the basis of need, it often is necessary to assign state finances to the various systems on a ratio out of proportion to federal aid. Here again, a sound program must be based on relative long-range needs and a state fiscal policy adopted to meet the needs, taking into account the continuing support provided from federal sources.

1956 Act Policy Beneficial

The policy established in the 1956 Act is most beneficial as a stimulus for long-range planning. Recently, F. C. Turner, Deputy Commissioner and Chief Engineer, Bureau of Public Roads, had the following comment on programming:

> In a long-range program of this sort which requires so much advance planning by highway officials and engineers; a program which involves land acquisition, removal and disturbance of families and businesses, relocation of public and private utilities – all of which demand close cooperation and co-ordination between many groups, including contractors, manufacturers of equipment, and those who supply materials – a steady predictable flow of projects over a period of several years' time is essential.
>
> Such a large nationwide activity cannot proceed in an efficient manner if it progresses in spurts of unknown and erratic amount with large fluctuations.
>
> To achieve this steady flow, a big task, being worked on in the Bureau and the states, is to have each project which is to be built on the interstate system during each of the next five years scheduled into our production line, with the remaining work grouped into two or three similar schedules for the ensuing periods of four or five years each.
>
> Thus the work will be lined out progressively, step by step, year by year, for every mile of the system. This will permit the states to balance their work load and carry the program forward, putting high priority projects first to achieve a usable component of the system at the earliest

possible time. It will enable the states to make the best use of their working forces, whatever the stage of development of a project.

It is the same idealism Mr. Turner refers to with respect to the interstate system that highway administrators in the state, city or county hope to achieve with respect to other systems. Even though a fiscal plan is less than ideal, the development of a sound programming procedure will produce very material benefits.

While every highway agency does program its work one way or another, many are striving to establish criteria which reduce pure judgments to the minimum. They are striving to make measurable facts serve to guide most decisions, recognizing that there is no substitute for competent and seasoned experience. Yet the objective is to let engineering analysis guide program development to the greatest extent possible.

Can Offset Distorting Influences

In following an approach using engineering criteria basically related to desirable standards of highway improvement, the engineer-administrator can offset many distorting influences. If his approach is soundly conceived, he can generate support for it from those – who through lack of understanding – might be prone to criticize. Often, forces of politics or sectionalism traditionally have been brought to bear on the sequence of highway improvements. Without clear-cut evidence to demonstrate errors found in some of these pressures, they are bound to continue. On the other hand, the real strength of political life is in making the right decisions. If the forces can be assured of the soundness of a program which is designed to do the most important things first, they are likely to become the most staunch supporters.

Can the Ideal Highway be Achieved?

If Americans could arise tomorrow and find all their highways rebuilt to the desired standards, the effect would be almost unbelievable; indeed the idea, perhaps, is inconceivable.

Maybe the reader should stop here and try to visualize the impact such a state of transportation-utopia would have on him and his community.

Actually, when we discuss an optimum state of highway develop-

ment, we are – at the moment, at least – dealing with unreality. Certainly, the optimum state is what we need and what we hope for.

But to reach it, we must possess two fundamental things – time and money. How much time we need will depend largely on the funds made available; intelligent and informed use of both is essential.

We can say this with complete assurance: Time and money both can be wasted if the highway administrator fails to do first things first. But with proper systematic program selection and scheduling procedures, we can expect confidently to come closer to idealism – a fully adequate highway system.

The Regional Center and Downtown

KENNETH C. WELCH

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REGIONAL suburban shopping centers pose an entirely new twentieth-century architectural problem. They have been through curious, almost abortive stages in their development. The design process, often a long, evolutionary period for such a complex problem, has been accelerated, because of a highly competitive situation. In several metropolitan areas, more centers have been constructed than the market can currently support. In some cases it will take years for the suburban market, in population and disposable income, to catch up with these developments. A more scientific, less optimistic, market analysis could have foretold this result.

The design process for the last three decades has been governed by the opportunist, who never quite realized to what extent the automobile was influencing our way of life. He followed the path of least resistance, appealing to chain managements who were organized to decentralize as population did. These first centers were often built at one time under the direction of an individual land or building speculator, with a high degree of foresight. Based on an outmoded grid pattern, originally with curb parking, there were many examples of this type. All added more parking, and some have been saved by the construction of contiguous high-rise apartment dwellings – a process also being promoted to help downtown.

It is only recently that responsible bankers, corporations or large department stores have sought the aid of a team of analysts, planners, traffic and other engineers, imaginative architects, landscape

architects, artists and sculptors, skilled retail management – all under the direction of a developer who realizes he can best become a partner in the retail business as well as perform a constructive service to the community.

The better-designed centers have not only adopted from the financial, psychological, economic and social viewpoint the most advantageous features of the best large centers, but many adaptable assets of downtown as well. They have also created some new features.

Only recently has the suburban homemaker been given prime consideration in the designing of suburban shopping centers. By a logical evolutionary process, we are arriving at a design concept for the suburban center that she prefers as a shopping environment. It combines maximum convenience in all important elements – ease of access, minimum walking distances from car to store, store to store, and location of merchandise lines. It further combines all-weather shopping, built-in beauty, a community focal point and many other desirable elements. Most important, this design concept appeals to the best type of tenants – and the quality and quantity of tenants are indispensable ingredients.

Heretofore the governing design factor was the parasite-type of variety and apparel chains that based their decisions on the so-called "proved concept," which was first the ribbon and then the strip center. The consumer, through her own experience, has been given a glimpse of this new kind of center.

Because of its advanced design and the layman's difficulty in comprehending its full potential, real estate brokers – accustomed to following earlier designs – cannot successfully direct the complete leasing of the advanced design center. The modern concept, with greater consumer-appeal and consequently greater return to the developer, may require a broker having an equity or other enlightened interest in the center.

Center and Retail Goods Defined

The term "shopping center" has been badly abused. There are many neighborhood and so-called community centers, most retailing convenience goods. This article deals mainly with the newer

suburban regional center, completely planned and integrated as a unit under a single management. It has at least 200,000 square feet – more ideally 800,000 – of rentable area, with 70 to 80 percent of this area devoted to shopping goods stores rather than to convenience goods or services. Parking facilities must be sufficient to handle most of the Christmas peak.

Convenience goods are daily, weekly needs. The Census uses as a "convenience goods" index the sales in food stores, restaurants and drinking places, packaged liquor stores, and drug stores. These always have, as their name implies, been dispersed throughout an entire urban area. Today, there is a supermarket no farther than five to seven minutes from the average home in any urbanized area.

We are primarily interested here in shopping goods – fashion apparel and home furnishings. The Census Bureau uses as their basic groups, General Merchandise, Apparel, and Furniture-Home-furnishings stores (GAF) as an index for "shopping goods."

We use GAF purchases and sales in our modernized law of retail gravitation. This method of determining potential sales of shopping goods has been tested many times and it is remarkably accurate. It is the one method that scientifically considers purchasing power of consumers and competition. It is valuable as a selling tool, in the rental process, in financing and for planning store types and proper directional flow of external and internal traffic. Some refinements have been introduced but the general principles still apply.

The important factor is that size and sales of GAF presentations determine the pulling power of a shopping goods center or collection of stores.

The real estate managers of chain GAF, mail order outlets, and other branch operations must follow and be guided by policy from above. These associate executives in merchandising and other departments are not always familiar with a particular location or its problem. The real estate managers of the largest chains, in the interest of simplifying their complex task, have had to recommend, especially in the past, that organizations follow what was heretofore the proved path – participation in the many strip centers.

These strips, including originally the ribbons flanking older city-thoroughfares, were as a rule successful because of the great

demand for more convenient retail outlets away from downtown. The planned strip will continue to be successful when it has good tenants including some local independents of prestige, and enough parking.

However, when circumstances make it possible for a modern center to come into the same market area with equally good tenants, it can attain a higher, more profitable productivity, enjoy greater success, and can hurt the strip, especially the thoroughfare ribbon. The modern center can do this long before permanently harming downtown. If downtown puts its house in order, it offers advantages that no regional center can ever have.

The most important ingredient in any kind of center is the quality and quantity of its stores and services. Well-established downtown stores have acquired invaluable prestige through generations of service and have created an almost unbelievable pulling power resulting in a concentration of pedestrian traffic in the high structural density or downtown core area. They have spent millions of dollars on regional publicity. The chains, paying high rentals and doing little, if any, advertising, have thrived on the traffic that these local stores have generated.

Branches of these local department, apparel, and other specialty stores can create and maintain the same pulling power in the suburban regional centers. Such stores grouped in a regional center make it a satellite of the downtown retail area with its ability to attract customers from a greater distance. Local stores are beginning to acquire the necessary know-how for operating multiple store units, which heretofore has been the forte of the chain. This know-how has been one of their major problems.

Another basic reason that the chain variety store – often a key tenant in the smaller center – does not have this pull is that it sells largely standardized package goods, found in many outlets, and at uniform prices. They are in reality not shopping goods stores but a form of convenience goods outlet. They are essential, but generally to a limited degree to complete the proper proportion of GA or GAF presentation in the well-balanced regional center.

These chain-variety stores originally established units in the outmoded thoroughfare ribbons that now have poor access and inadequate parking. Today these chains, to maintain their com-

petitive position in an area, have to put stores in the majority of the numerous strip centers still being constructed.

One general merchandise chain operation is an exception to this rule – the mail order retail outlet. These outlets carry more lines than the largest department store and, accordingly, can alone create a regional pull. This fact made it possible for them to pioneer in obtaining locations away from the CBD core, where they could provide their own parking.

Often their policy was to keep as close as possible to the central district. They are classed by the Census and others as a department store but they have far outstripped their competition in sales because of a unique and skilled operation supplemented by large mail order sales, and because of their aggressive expansion policies.

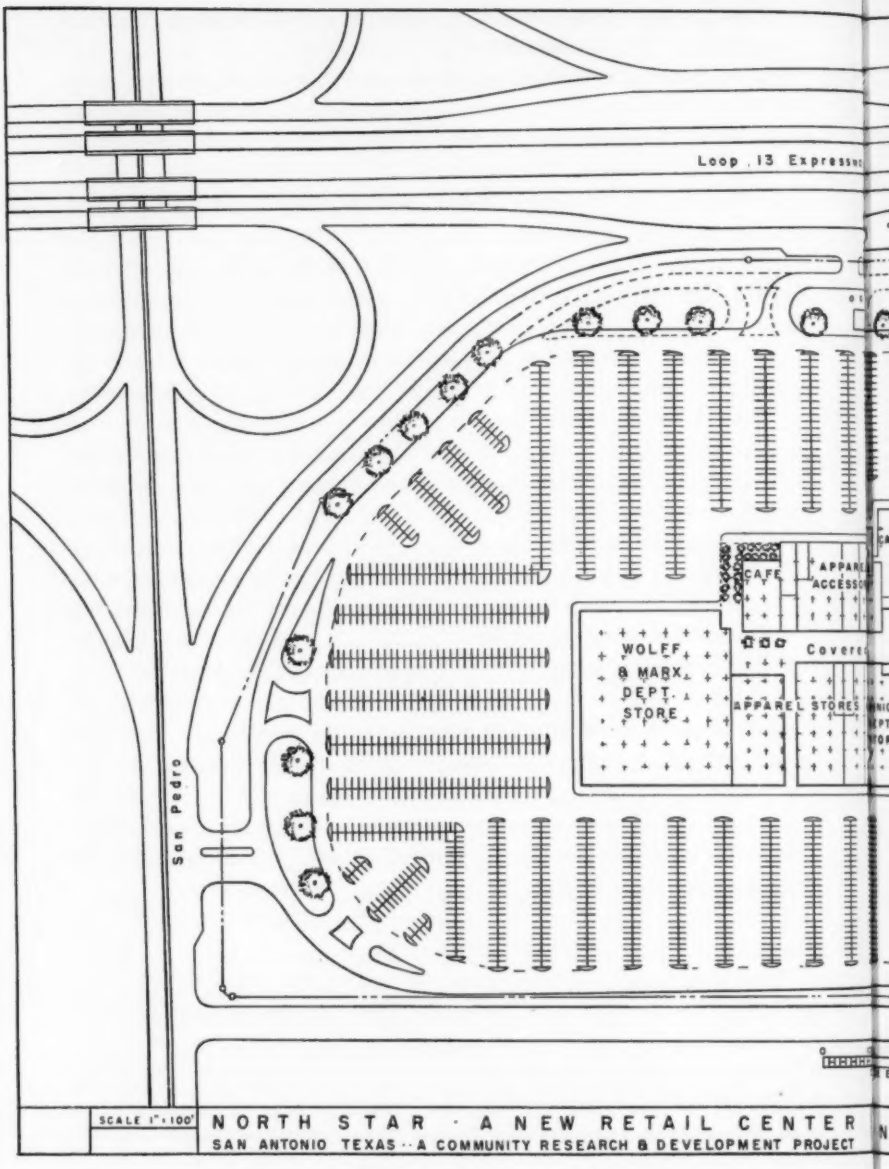
The Harvard figures for 1956 show increases from 1946 and 1948 to 1955. In this period, department store sales increased only 26 percent, total retail sales 50 percent, when disposable personal income increased 58 percent.

Sears and Wards sales increased in this period 39 percent. It surprises many to learn that Sears had more than $3 billion in sales last year, of which 26 percent was mail order; and Wards had about $1 billion. Together they had in 1929, 17.2 percent of all department store sales in 1929; in 1953 this percentage increased to 36.3.

This record is one reason that many authorities rightly say the regional center must have a branch of an established publicity-minded department store to be successful. Unfortunately, many speculative developers had to secure a high percentage of chains with AAA credit to mortgage out their investment; but as a rule those who have negotiated a branch of an established department store have been successful.

Visibility from the Highway

Before analyzing the design process that created the modern center, it would be well to consider the shortcomings of the strip center, whether it be single line, an L or a U (generally called a "Plaza.") As the size of the center increases, the shortcomings increase. The planned strip is a natural outgrowth of the thoroughfare ribbon which originally fronted directly on the street. Some still do on the


Loop 13 Expressway
San Pedro
CAFE
APPAREL ACCESSORIES
WOLFF & MARX DEPT. STORE
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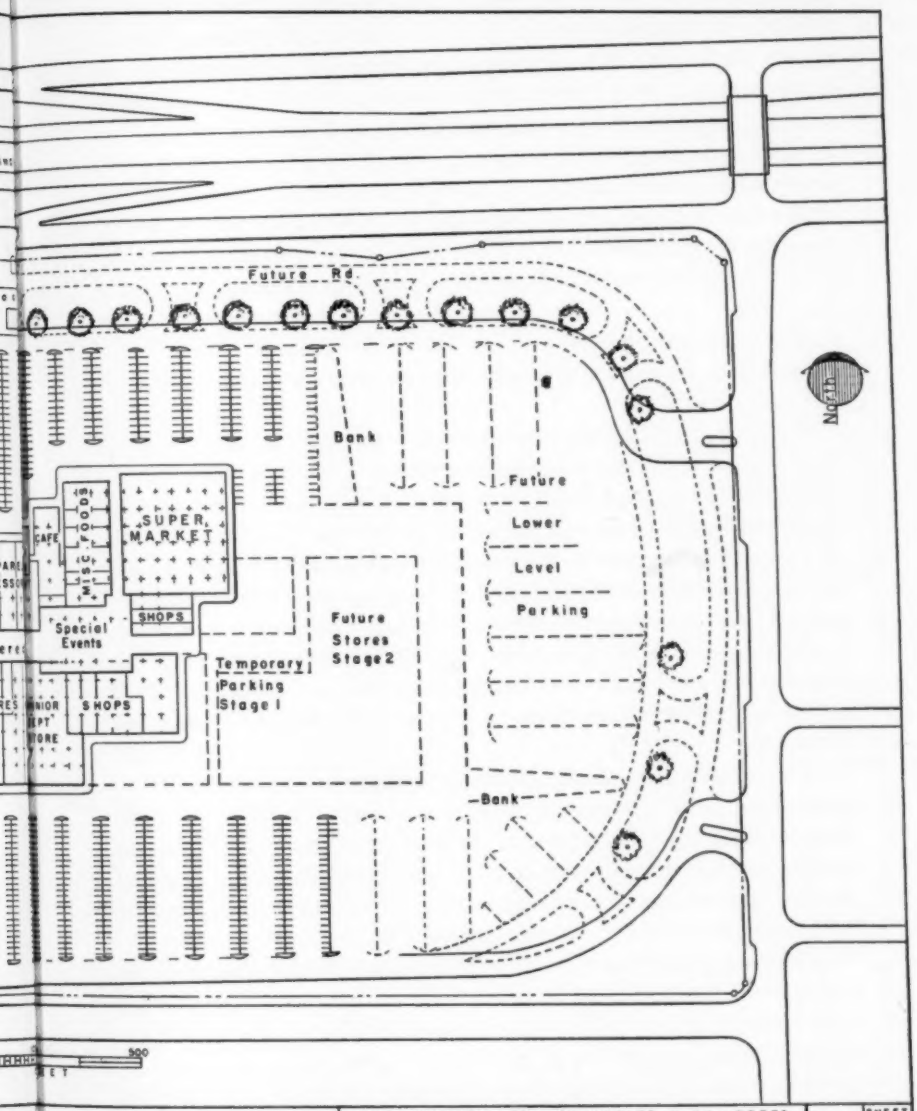
NORTH STAR · A NEW RETAIL CENTER
SAN ANTONIO TEXAS · A COMMUNITY RESEARCH & DEVELOPMENT PROJECT



NG PLOT PLAN

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theory that they must be completely visible from passing vehicles. They have confused the value, from a pedestrian's viewpoint, of downtown display windows with their almost complete lack of value as seen from a moving automobile. It is important only that there be ample parking and their signs be visible from the highway.

When speculative developers moved farther out on relatively low-cost land, they could have more parking, which is often placed in front of the stores, but they continued to adhere to the "visibility from the highway concept." When this idea is the prime criterion for a strip center opening on to an open sea of paving filled with thousands of automobiles, the result is neither beautiful nor conducive to attracting passing motorists. In fact, visibility into stores is impossible because of the reflected sky-glare on parked cars and show windows.

Consumers in the Boston area are attracted to key stores at Washington and Winter streets because of their ample selections, their prestige, the service they have rendered the community for years, and because of their mass advertising in local newspapers and on the air. No one goes to these stores because they are visible from the means of transportation used to reach them. In fact, the majority of customers reach the stores by subway. Further, there is little convenient parking in downtown Boston and certainly there is vehicle congestion. These stores will continue to prosper but they have long realized their efforts must be supplemented by suburban branches.

The majority of central business districts have been losing ground for more than a decade. They have lost sales in constant dollars to the suburban stores as shown by the recent CBD Census studies comparing 1948 with 1954. Typical of the CBD losses in this six-year period are three large metropolitan areas with varying geographical and retail factors and patterns.

These areas, with their 1950 population, U.S. population rank, and six-year total retail sales gain are:

	1950 Population	*Rank*	*Retail sales gain*
Philadelphia	3,671,048	4th	30.6%
Detroit	3,016,197	5th	39.4%
St. Louis	1,681,281	9th	32.5%

In this six-year period, downtown Philadelphia lost 7.3 percent of

its GAF sales; St. Louis 12.9 percent; and Detroit, with a regional center shock treatment, lost 15.8 percent. The total metropolitan GAF sales gained 14.4 percent, 13.5 percent and 22.9 percent respectively.

Certain other factors must be considered. For example, department store strength – indicated by the fact that 34.7 percent of all metropolitan GAF sales were in department stores in Philadelphia, 43.1 percent in St. Louis, and 40 percent in Detroit; and further, 71 percent of all department store sales were in downtown Philadelphia, 59.5 percent in downtown St. Louis, and 48.3 percent in downtown Detroit.

The GAF gains in the metropolitan area minus the CBD were in Philadelphia 36.7 percent, St. Louis 39.7 percent; but Detroit gained peripherally 53 percent.

Other pertinent general factors are: Philadelphia, a higher density city, had no really modern regional centers operating in 1954. Detroit, with a low density urban sprawl, has the most dominant downtown department store in the country, J. L. Hudsons, which has created outstanding regional centers.

Detroit also has many outstanding, decentralized mail order and other department stores, strategically located. Apparel stores are also more decentralized, 29.6 percent of their sales being in the CBD, as against Philadelphia's 34.7 percent. Homefurnishing stores are even more scattered, 7.2 percent of their sales being downtown; Philadelphia's, 15 percent.

St. Louis, more nearly like Philadelphia in metropolitan total retail and GAF sales gains, has had a greater GAF gain in outlying areas – 39.7 percent vs. 36.7 percent – because it has good department stores which have up to 1954 done a better job in creating regional centers and branch stores. Detroit is more automobile conscious, and while it was not reflected in 1954, its urban expressway system and municipal CBD off-street parking programs are well advanced.

The great majority of central business districts have, in the face of rising operation costs, depreciated in assessed valuations and as an important source of municipal tax revenue that they were at one time. Municipalities are naturally worried but are beginning to consider corrective measures.

There are few cities today that are not considering programs of modernization and rehabilitation for their central business districts. The success of the integrated, planned-as-a-unit, regional center has been the catalyst which has made downtown raise its head out of the sand. In smaller cities, strategically located new centers with generous parking have hurt the old downtown areas. But downtown has certain monopolistic advantages that must be promoted and nourished. It is essential that such a rehabilitation become an integral part of the cities' comprehensive master plan.

Downtown Emulates Shopping Center Features

It is interesting to note that central districts, when planning a complete modernization and rehabilitation, try to emulate the principles and elements that have been successful in the better regional centers.

First, planners realize that downtown must have better *access* from the suburbs as well as from a total trading area that can comprise several states. Current expenditures for interstate highways and their extensions into, through, and around the CBD contribute toward solving this problem – until such time as these costly expressways become inevitably overcrowded. Other factors that relieve congestion are elimination of curb parking and creation of one-way streets.

It is vitally important that these expressways in the large city be used to speed up an ailing but necessary mass transit system rather than merely to provide arteries to permit more private cars to reach downtown. These expressways can become a two-way affair. Not only can they bring more outlying customers downtown but they also enable the close-in resident to reach the suburban center.

A second feature that downtown is attempting to copy from the regional center is a maximum amount of short-time convenient *low-cost* parking. Few cities can afford free parking and the larger the city the more the economic factors influence the quantity, the cost to the consumer, and the convenience of the parking.

Studies show that the consumer is rebelling against excessive charges made for private parking facilities. When badly needed

parking is in short supply, charges appear as high as traffic will bear. The all-important suburban consumer compares these charges with the free, more convenient parking in the modern regional center.

Too many cities have sanctioned parking charges that are unnecessarily high by their attitude that the great majority of CBD parking should be provided by private enterprise. Downtown parking, and access to it, should be a vital part of the total urban transportation system. Many cities have made remarkable progress in providing convenient publicly owned parking facilities at a lower cost to the consumer.

Streets are and must be a public utility, and downtown off-street parking is nothing but a vital extension to the street system. Obviously the government, with its power of eminent domain, elimination of taxes, and ability to control vital traffic patterns, can furnish a permanent terminal area at the lowest cost to the public and consumer. This reduction in parking charges, plus conveniently located facilities, can do much to save downtown private enterprise, retailing, and other business of all kinds – an economic necessity more important than saving the private parking lot enterprise.

The core of the CBD, according to data from the Bureau of Public Roads, averages twenty-six percent of the total CBD area and contains twenty percent of the CBD parking space, but accommodates sixty-seven percent of the shopper-parkers.

Considering the high density of the tall buildings, the economics of the problem, the walking distances and highway capacity necessary, downtown can provide only a fraction of the parking it could actually use. It is this logical density of structural use that is the prime strength of downtown. It always will be, because it is essential to any metropolitan area to have this focal point of great activity in an area small enough to be transversed on foot. This strength is also a weakness because unlike the regional center it cannot conveniently accept the private automobile as its main means of transportation.

Increased highway capacity and parking facilities generate more automobile traffic which in turn requires more highway capacity and more parking. Many people loosely use the phrase "ample parking" when they should say "maximum parking possible under the conditions." The best-located and planned outlying

center, after reaching optimum productivity, has difficulty providing convenient, 100 percent parking for the Saturday before Christmas. Ample parking is the ability to handle ninety percent of this seasonal peak.

Types of stores, their productivity, average shopping time (which determines parking turnover) also affect the Parking Index[1]. For example, a supermarket alone has a high turnover with an average shopping time of less than thirty minutes. Department and apparel shopping goods stores can collectively keep customers in the center for hours. A furniture store, because of its low productivity, does not require a great deal of parking in relation to its floor area.

To provide a parking index of three in high structural density areas and to maintain reasonable walking distances for principally the short-time shopper-visitor parker, multi-story garages are necessary. In a large city where a parking index of three might be recommended, it would become impossible to provide the highway capacity, physically or economically, to handle this number of cars.

A third factor, one of the greatest advantages of the well-designed regional center that downtown should emulate, is the elimination of the conflict between vehicles and pedestrians. The more active the downtown, the more annoying these conflicts can become.

Proposals to convert main streets into pedestrian malls and divert traffic around it to provide perimeter off-street parking can work well under certain circumstances in smaller cities. The larger the city, the more difficult it becomes to achieve this advantage, primarily because of the highway capacity required. Because of many conflicting land ownerships, often controlled by estates or absentee owners, and the considerable costs involved, the obstacles are difficult to overcome.

The fourth advantage of the regional center is in the publicity so necessary to shopping goods sales, in the fact that the regional center does well because of its single ownership, and the requirement that merchants join an association to plan and direct a given amount of publicity. Downtown associations are improving their technique in this direction. Special events and a promotional area placed in the center as part of the enclosed pedestrian street in the modern center produces in itself traffic and good public relations.

1. The number of car spaces per thousand gross square feet of generating area.

Downtown's cultural and entertainment appeal is to an area much greater than the limited suburban appeal of the suburban center.

Assets of Downtown

Downtown assets that the regional center can emulate to a varying degree are: *First, a maximum presentation of shopping goods* with only the convenience goods necessary to serve the shopping goods shopper. In contrast to the smaller, more convenient center that specializes in the shopper's daily and weekly needs, this provides the maximum presentation and pull from the greatest distance because in any center, catering largely to motoring patrons, there are parking space limitations.

In single-level centers of more than a million square feet, walking distances become too great. This condition also applies to downtown and creates one of the current CBD problems. It has been rightly said that if walking distances are not a consideration, then no downtown has a parking problem.

By carefully planning a balanced presentation and by avoiding an excessive proportion of convenience goods not having a 100 percent shopper's appeal, an outlying center can be made a satellite of downtown's concentrated retail area. In this manner, a maximum merchandise presentation in depth (size, color and style) can be realized. This at best can only partially overcome downtown's monopoly on quantity of presentation.

There is a recent trend to increase presentation in limited lines, and accordingly increase the pull in terms of distance and productivity. Instead of trying to create a "one-stop center" (a misnomer, because only downtown can approach this definition) the trend is to a zoned shopping appeal. In California and Florida, centers have been planned with only fashion apparel shops, plus a minimum of convenience goods, for example, a restaurant. They have no supermarket and a few hard goods.

In this manner the maximum cumulative pull is created for fashion shopping goods, approaching in a way the downtown pull. In this manner, it is possible to keep walking distances from parked car to the pedestrian street within an acceptable 350 feet maximum, 120 feet median.

A second asset is that downtown has a great concentration of

pedestrian traffic in the AAA retail area, always a two-sided street. One-sided streets opposite parks or non-retail uses are dead or dying. The amount of pedestrian traffic is the index of the front-foot dollar value. The well-planned outlying center improves over the downtown two-sided street, which also serves vehicle traffic, in that it creates a two-sided street, 100 percent pedestrian. This layout permits shopping back and forth as well as along the street and thus creates as much purchasing power per front foot of display as downtown and produces more impulse sales.

The third advantage of downtown is the greater variety of retail stores and services, permitting more errands on one trip.

Some CBD functions do not fit into centers. Downtown's small high-fashion store, personally operated and with a high-income appeal, finds it difficult to operate a branch. The symphony orchestra, the theater, the main governmental agencies are found only in or near downtown. There are innumerable highly specialized retail outlets and other services adjacent to the inner core that would normally be visited only at infrequent intervals by a homemaker.

The downtown hotel and restaurant, necessary to the transient, along with their convention potential, often have an appeal for the local suburbanite.

A fourth asset is the downtown labor force, an important part of the downtown retail market. The career girl's fashion apparel expenditure is proportionately much greater than that of the homemaker. It is her stock in trade. This advantage cannot be repeated in the regional center. Central Business District studies[2] show that in Grand Rapids twenty-five percent of the total floor space is in retail area and twenty-seven percent in office area; in Tulsa twenty-three percent retail, and thirty-eight percent office area.

Regional centers providing the maximum retail area and pull cannot introduce any great amount of office space as an integral part of the center because of the conflict in parking use. Workers, arriving before shoppers, are inclined to absorb convenient spaces. Medical centers and other services should be located on large tracts with captive parking for their own use, available for evening overflow peak parking.

There has been a natural and unavoidable decentralization of

2. Murphy, Vance and Epstein, Clark University.

medical professional offices. Other professions having downtown contacts or requiring frequent direct contact with other central businesses, banking institutions, governmental agencies and others, are better located in the CBD. Certain businesses requiring a clerical or kindred semi-skilled labor force have found that to decentralize and move away from the hub of the mass transit system, materially limits their labor market.

A successful civic auditorium, part of most central cities today, is usually located close to downtown, can be approached in only a small way in the regional center by creating a special events area and where the key department store has an auditorium which can be used for retail selling in December.

Design Factors in Regional Centers

We are interested in having only a few of the stores and store fronts visible from the highway. Customers are attracted to the large regional center in the same way they are attracted to the key stores in the CBD, by publicity and by a knowledge of what they can expect to find there in the way of merchandise and the service that goes with it.

Outside of the employees who can use more than ten percent of the parking space, 99.9 percent of the cars leaving the highway and driving into the area carry customers who will become pedestrian shoppers. A basic function of the design is then to subject these potential shoppers to the maximum amount of displayed merchandise, with a minimum of enclosed glass, store fronts or cases, but with open displays at the point of sale.

From the standpoint of attracting the customer inside, and because of the economics, the only store fronts visible from the highway should be the entrances to the large key stores or the convenience goods stores, even on Sunday, when key stores are closed. This visibility is necessary to show that they are open.

The mall or two-sided pedestrian street is entirely enclosed and air conditioned. In the streets, there can be concessions, selling high impulse goods. There are planting, sculpture the children can play on, benches for relaxation, aviaries, sidewalk cafes, and other features to make it an interesting, exciting place.

There are few show windows on this interior street. The majority of the stores open up wide by means of disappearing grilles or sliding glass doors directly into the street.

The mall type center with its logical, single two-sided pedestrian street is proving, because of its concentrated pedestrian traffic flow and "directional" helpful visibility to a maximum number of stores to be superior, in productivity, to the double mall or cluster type. The open mall, with its attractive planting and sculpture, and cluster type centers will always be successful where they have a quality and quantity of prestige tenants that no other center in the area can easily reproduce.

Seen From the Highway

It is like an architectural problem requiring large areas of parked cars, that should be convenient to the structure, such as the stadium or the race track. The exterior must be properly designed to show the character of its function. Its immediate surroundings – a mass of parked cars – though in organized pattern, are not beautiful. Nor do a few trees planted here and there make it so.

There can be some trees to help direct traffic, provide some shade, relieve the mass of paving, and help the setting of the main structure. So we strive, architecturally, to impress the automobile occupant with an interesting architectural mass, with ample, well-designed, individualized, but co-ordinated signs listing the tenants. The plan is then to get the customers' cars parked in the shortest possible time and encourage the occupants with a minimum walk to become pedestrian purchasers in the interior at the point of sale.

We are concerned with a pleasing aesthetic environment from the *interior viewpoint*, not only because customers are exposed to it for a longer time than they are to the exterior, but because it is next to impossible and not really necessary to try to improve the appearance of thousands of parked cars.

The elimination of areas of exterior glass and show windows is an important element in reducing cost. Some of the fine centers developed by large department stores, costing from $22 to over $30 a square foot of rentable area, with proportionate costs for maintaining common areas, obviously must and can obtain higher

rentals. In designing for individual developers, it is frequently necessary to lower these costs as much as fifty percent.

Exiting traffic can in an hour equal more than ninety percent of the accumulation of cars, or at peak-times ninety-five percent of the total capacity. In designing the entrances, exits and channelization, the traffic engineer must ascertain that this traffic, plus the contiguous non-center traffic will not exceed the capacity of adjacent highways. It is wise to dedicate land for additional right-of-way to provide wide median strips and ample lanes adjacent to the center. Fortunately, the greatest non-center traffic occurs between 4:30 and 6:00 P.M. Peak exiting traffic is at night when the center is open.

Customers can walk with safety in a bay that has ninety-degree parking, when the bays are approximately at right angles to the ring road. A car entering or leaving the parking area, instead of having to loop, as they must with angle parking, can enter and park in a vacant space in any bay and later exit from the direction they entered.

It is as easy to park a car in one motion in a sixty-five-foot bay with nine-foot wide stalls marked with double lines, as with angle parking requiring one-way traffic in the bays. In the large center, with more than fifty bays, where the total traffic is broken up into more than fifty parts, there is no great amount of traffic at one time in any single bay. This reduces confusion and increases the safety factor. Stalls should never be less than eight feet six inches wide, and preferably nine feet.

It is important for community public relations that there be a large-size common area near the center of the enclosed street, called a special events area. Many examples exist in well-designed centers. The space should be ample to accommodate exhibits, promotions, public gatherings, and community affairs. They create an important community focal point with their cultural and educational features.

Location of stores by type, demand, novelty, or impulse to create a well-distributed traffic is important. Studies by New York University show that impulse sales can be almost fifty percent important in any store. Impulse sales, possible to a maximum degree only when in the maximum traffic flow, are important to productivity.

One of the great advantages of the department store in the past, when it was the king of retailing, was that it presented a great many lines and departments under one roof. In reality, this modern concept of the enclosed mall center is like the department store, except that, instead of departments, they are private enterprises, many with the extra incentive of being in competition with one another. This is the same competitive enterprise that has made this country great. Further, the independent department store in a branch operation can reduce the presentation of, or even eliminate, certain lines that may not be profitable and are better merchandised and relatively more profitable in certain other independent stores or in a chain operation.

Financing is vital. Many centers have had serious difficulties leading to some poor leases, resulting in insufficient returns to meet the debt service.

The condition of the money market in 1957 made it difficult to create a successful center unless a majority of tenants were national chains with high credit rating. The possible long-range advantage of a maximum number of local prestige type stores has been lost unless a certain amount of equity in addition to mortgage funds is provided by the owner or a corporation with risk capital. The most successful centers today have been developed by large dominant department stores.

Modern management requires all tenants to join and contribute to common center publicity controlled by a merchants' association. Good center management today requires that the post of secretary of this association be a full-time position. The secretary must spend the majority of his time planning promotions and other events to assure good public relations. It is obvious that 100 percent participation in such a program, administered under these conditions, has advantage over downtown promotions.

Traffic Trends in Florida

MELVIN A. CONNER AND SHERWOOD H. HILLER

Mr. Conner is engineer of traffic and planning, Florida State Road Department. From 1936 to 1944 he was on the staff of the planning survey division of the Kansas State Highway Commission, and became engineer of traffic. Later for six years he was engineer of urban studies for the Ohio Department of Highways, in charge of traffic and parking studies for Ohio cities. Mr. Conner developed the technique known as the Ohio Controlled Postcard Survey Method.

A registered professional engineer in the states of Ohio and Florida, he is a member of the committee on traffic and of the subcommittee on factual surveys of the American Association of State Highway Officials and a member of the Department of Traffic and Operations of the Highway Research Board and serves on project committee No. 2 origin-destination surveys. He is also a member of the Institute of Traffic Engineers.

Mr. Hiller has for seven years been assistant engineer of traffic in the division of traffic and planning of the Florida State Road Department, in charge of urban surveys of Miami, Sarasota, Orlando, Palm Beach County, Tampa, Interstate Traffic Study, and other special studies. He has done extensive work in the application of punched card and computer techniques to traffic analysis. He presently heads the Research section of Traffic and Planning.

Previously Mr. Hiller was on the staff of the planning survey division of the New Mexico State Highway Department, as field supervisor of the Albuquerque parking survey and office engineer on capacity studies of that survey. He is an associate member of the Highway Research Board and an associate member of the Institute of Traffic Engineers.

FLORIDA is unique among the states because of its fairly recent evolution from an economically backward and sparsely populated area of swamps, pine trees, sand and fishing villages to a power among the leading states in agriculture, industry and tourism. Traffic volumes reflect the always interesting and sometimes amazing growth of Florida as well as its rapidly shifting areas of development.

Systematic traffic counting as we know it today, began in 1936 with the establishment of the Planning Survey. The program for installing "permanent" traffic counters was modest. Six electric

eyes were installed the first year. Servicing difficulties were experienced, and the first reliable volume counts were not obtained until January 1937.

In addition to permanent counters, one man set portable counters over the state. A man accompanied him making manual classification counts and aiding in setting the old "AC" (accumulative counter) machines. Approximately ninety-six manual classification counts were made the first year and about 1,680 machine counts were obtained of which some 190 were hourly counts.

In 1957, two men worked full time to take care of the permanent counters increased to sixty-five. Ten men are needed to set the portable machines. These are set at 5,400 rural locations four times each year for a total of 21,600 rural twenty-four-hour counts. The same crew set about 3,000 urban stations once annually resulting in a total of 24,600 regularly scheduled rural and urban traffic counts each year.

The number of manual classification counts has increased. In 1957, five men classified 360 scheduled locations four times for a total of 1,440 manual classification counts. Table I summarizes the growth of the counting program during the twenty years from 1937 to 1957.

Table I

	1937		1957		
	Personnel	*Locations or Counts*	*Personnel*	*Locations or Counts*	*Increase of Portable and Class. Counts*
Permanent	—	6 locations	2	65 locations	
Portable Counts	1	1,680	10	24,600	14.6 times
Classification Counts	1	96	5	1,440	15.0 times
Total	2	1,776	17	26,040	14.7 times

Figure 1 is a map showing the location of all permanent recorder stations.

The increase in productivity per man is attributable mainly to the increased density of count coverage so that less time is lost traveling. Additionally, however, experience with the problems involved as well as better equipment have contributed to greater efficiency.

In order to handle the mass of data, the portable traffic counts

are being key punched into punched cards. We are now in the process of converting to "mark sense" cards, filled in by field personnel, which will eliminate most of the key punching in the central office.

Manual classification counts were lately put on punched cards. We expect to put the hourly permanent recorder counts on punched

Figure 1. Permanent recorder station locations.

State Road Department of Florida – 1957

cards sometime this year using some of the newly available integrated data processing equipment rather than by key punching in the machine room.

Growth of Florida

During the twenty years from 1930 to 1950, the United States as a whole grew from a population of approximately 123 million to

about 151 million people. This is an increase of about twenty-two and seven-tenths percent. During the same period, Florida grew from about one-and-a-half million people to almost three million for an increase of about eighty-eight and eight-tenths percent. In other words, Florida increased approximately four times faster than the nation as a whole.

This extremely rapid growth has continued to the present. The Bureau of Census has estimated the 1956 Florida population as 3,885,000. The Census Bureau estimate, while conservative, shows an increase of 164.6 percent over 1930, or an additional 75.8 percent growth in the last eight years.

In 1930, forty-eight and three-tenths percent of the population was living in rural areas and fifty-one and seven-tenths percent in urban areas. In 1950, only thirty-four and five-tenths percent of the population lived in rural areas with sixty-five and five-tenths percent in urban areas. The trend toward urbanization has continued.

The enrollment of Florida school children in the first twelve grades increased sixty-eight percent from 1946 to 1955. It increased eighteen percent from 1955 to 1957. This indicates that young family immigration, and therefore population growth, can be expected to continue at a high rate.

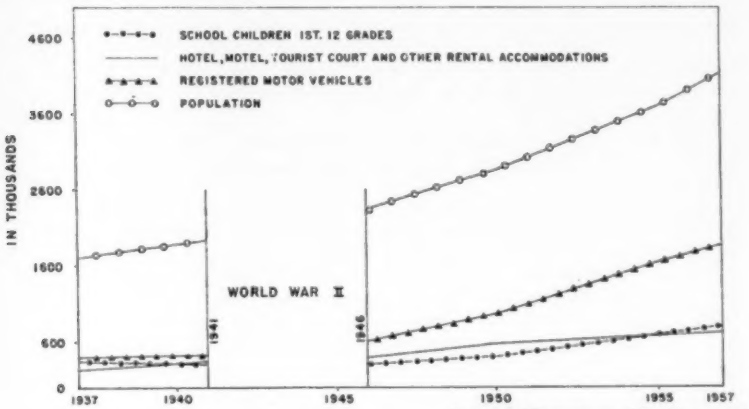
The permanent population growth in Florida is not the whole picture. An overburden of tourist population is superimposed on the permanent resident base. At one time, the tourist population was completely seasonal and compressed approximately into the three months of January, February and March. This is no longer true. The growth of summer touring in Florida is as large as for the winter season a few years ago.

The number of rental units in hotels, motels, motor courts and apartments increased from 371,000 in 1946 to 706,000 in 1955, or ninety and three-tenths percent. The construction of rental units is continuing at about the same rate at present with an increase of thirteen percent from 1955 to 1957 over the base year of 1946.

During the postwar period the number of registered motor vehicles increased from 607,000, in 1946, to 1,616,000, in 1955, or 166 percent. Registered motor vehicles increased to 1,994,000 in 1947 – an increase of 378,000 in two years.

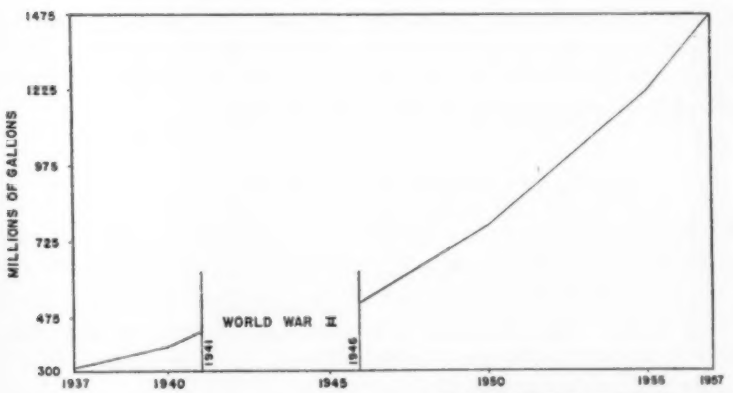
An index closely related to traffic is gasoline consumption. In 1937, the first complete year of the counting program, 316,655,000

gallons of gasoline were consumed. The 522,328,000 gallons consumed in 1946 was an increase of sixty-five percent. By 1955, gasoline use rose to 1,232,165,000 gallons, an increase of 136 percent



State Road Department of Florida – 1957

Figure 2. Index of growth in four categories.



State Road Department of Florida – 1957

Figure 3. Increase in gasoline consumption.

over 1946. In 1957, the 1,489,104,000 gallons sold in Florida made an increase of forty-nine percent in two years over the base postwar year of 1946.

Figures 2 and 3 give a visual summary of the various indices of growth.

Impact of the extremely rapid growth on the counting program has been severe. In addition to the apparent need for increased coverage, it has caused shifting of stations and rapid obsolescence of some locations in so far as trends are concerned. Only three of the original six permanent counter locations were being used in 1957. (Table II).

Table II

ANNUAL AVERAGE DAILY TRAFFIC
THREE ORIGINAL PERMANENT RECORDERS

Recorder	*1937*	*1946*	*1955*	*1957*
1 Baldwin . .	3266	2280	4160	4430
2 Crestview . .	713	905	1867	2281
3 Boca Raton .	2920	4468	6892	8405
Total	6899	7653	12,919	15,116
Increase over 1937		10.9	87.3	119.1

The combined count of the three stations in 1937 was 6,900 A.D.T., while in 1946 it was 7,700 A.D.T. This is an increase of ten and nine-tenths percent. By 1955, the combined total had risen an additional seventy-six and four-tenths percent over the base year 1937. In the two-year period 1955–1957, the combined count rose an additional thirty-one and eight-tenths percent.

General Traffic Growth

During the nine years between 1937 to 1946, there was an annual average increase of one and two-tenths percent over 1937. Naturally the war years depressed that period greatly. During the nine years from 1946 to 1955, the average annual increase over the base year 1937 was nine and seven-tenths percent. A good picture of the growth of traffic during the postwar years can be obtained from examination of activity represented by the composite A.D.T.'s developed from thirteen permanent recorder stations in operation since 1946. Table III shows the percentage changes by years for the thirteen stations.

Table III points out that the composite A.D.T. for the thirteen stations increased 127.1 percent from 1946 to 1955, or an average

Table III

STATE OF FLORIDA

TABLE SHOWING PERCENTAGE AVERAGE DAILY TRAFFIC IS OF PREVIOUS YEARS, DEVELOPED FROM THE COMPOSITE TWENTY-FOUR HOUR AVERAGE TRAFFIC AT THIRTEEN PERMANENT RECORDER STATIONS

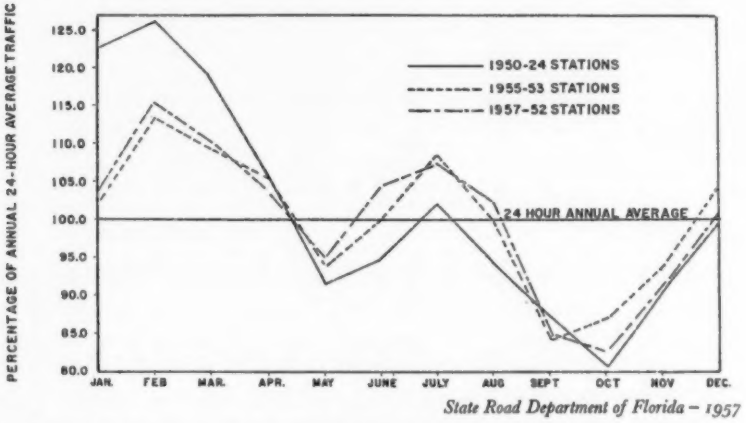
Year	*Average Daily Traffic*	*1946*	*1947*	*1948*	*1949*	*1950*	*1951*	*1952*	*1953*	*1954*	*1955*	*1956*	*1957*
	1969	%	2112	%	2333	%	2532	%	2905	%	2918	%	3495	%	3578	%	3959	%	4472	%	4626	%	5106	%
1946 . .	1969	—	107.3		118.5		128.6		147.5		148.2		177.5		181.7		201.1		227.1		234.9		259.3	
1947 . .	2112	93.2	—		110.5		119.9		137.5		138.2		165.5		169.4		187.5		211.7		219.0		241.8	
1948 . .	2333	84.4	90.5		—		108.5		124.5		125.1		149.8		153.4		169.7		191.7		198.3		218.9	
1949 . .	2532	77.8	83.4		92.1		—		114.7		115.2		138.0		141.3		156.4		176.6		182.7		201.7	
1950 . .	2905	67.8	72.7		80.3		87.2		—		100.4		120.3		123.2		136.3		153.9		159.2		175.8	
1951 . .	2918	67.5	72.4		80.0		86.8		99.6		—		119.8		122.6		135.7		153.3		158.5		175.0	
1952 . .	3495	56.3	60.4		66.8		72.4		83.1		83.5		—		102.4		113.3		128.0		132.4		146.1	
1953 . .	3578	55.0	59.0		65.2		70.8		81.2		81.6		97.7		—		110.6		125.0		129.3		142.7	
1954 . .	3959	49.7	53.3		58.9		64.0		73.4		73.7		88.3		90.4		—		113.0		116.8		129.0	
1955 . .	4472	44.0	47.2		52.2		56.6		65.0		65.3		78.2		80.0		88.5		—		103.2		114.2	
1956 . .	4626	42.6	45.7		50.4		54.7		62.8		63.1		75.6		77.3		85.6		96.7		—		110.4	
1957 . .	5106	38.6	41.4		45.7		49.6		56.9		57.1		68.4		70.1		77.5		87.6		90.6		—	

How to use the table:

1. Select a specific year in the horizontal line across the top of the table.
2. Follow down the vertical column under this year until it intersects the line horizontal with the year selected for comparison.

annual increase of fourteen and one-tenth percent over the base year of 1946. The original three stations counting continuously, showed only a seven and six-tenths percent average annual increase for the same period. This somewhat indicates the changing patterns taking place with the growth.

Table III further reveals that the composite A.D.T. of the thirteen stations increased an additional thirty-two and two-tenths percent from 1955 to 1957 over the base year 1946, or an average an-



State Road Department of Florida – 1957

Figure 4. Summary of traffic recorder data for years 1950, 1955 and 1957. Percentage of average daily traffic by months compared with the annual daily average data taken from all continuous recorder stations located on the State Highway System.

nual increase of sixteen and one-tenth percent. Traffic growth, therefore, for the postwar period 1946–1957, like the other related indices shows continued strength for the state as a whole.

Seasonal Characteristics

Traffic in Florida has some decided seasonal variations. The major peak occurs during the winter months of January, February and March. A secondary peak occurs during the summer months of June, July and August. The lowest point is reached during September and October. These characteristics are true for the state as a whole but not necessarily for certain sections.

Figure 4 illustrates the leveling off of peaks and valleys as the permanent population base has increased and the summer tourist season expanded.

Regional Differences

Composite traffic counts for the state obscure the considerably divergent patterns that occur in different areas.

Florida is divided into five Road Department Districts. Figure 5 is an outline view of the state showing the geographic location of

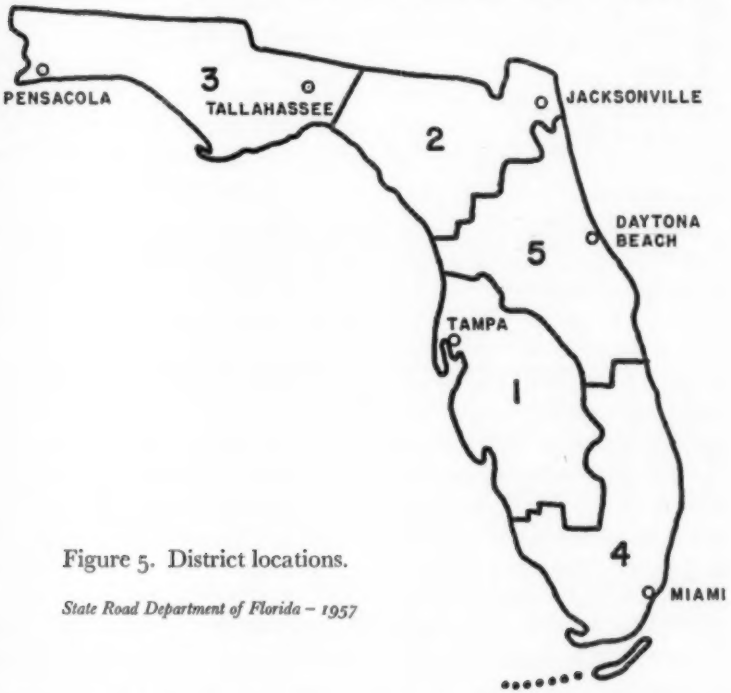
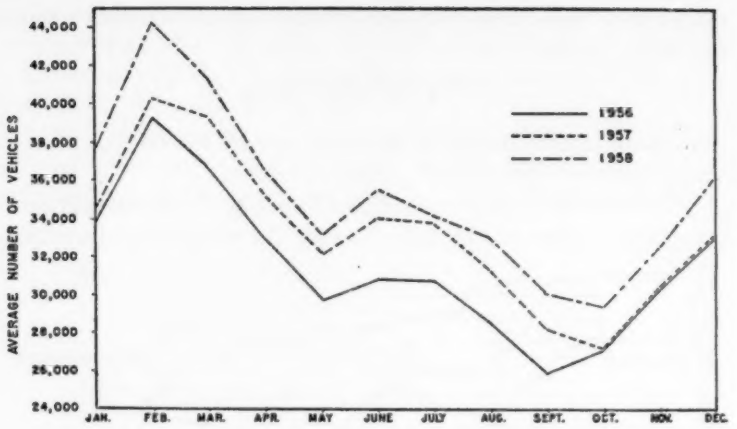


Figure 5. District locations.

State Road Department of Florida – 1957

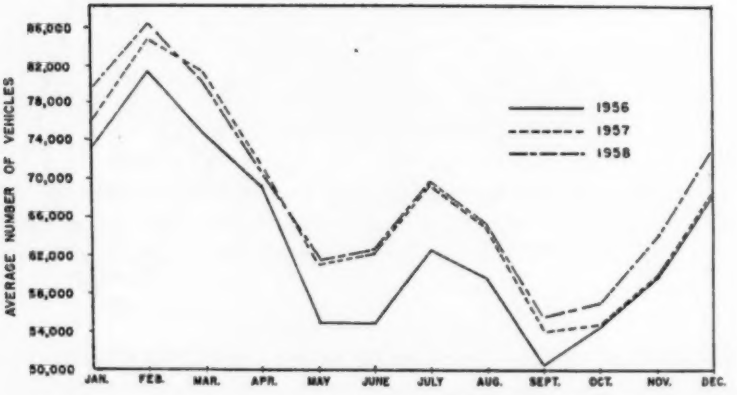
the districts. Although the districts do not correspond exactly to the regional traffic groups, they are close enough to illustrate the variations.

District 4 includes the "Gold Coast," part of which is Dade County, the most populous county in the state. This area is also the most heavily developed with tourist facilities. District 4 contains about twenty-eight percent of the population of Florida.



State Road Department of Florida – 1957

Figure 6. Daily average by months of vehicles at 10 continuous count recorder stations located in the First District.



State Road Department of Florida – 1957

Figure 7. Daily average by months of vehicles at 6 continuous count recorder stations located in the Fourth District.

District 1, which contains the major west coast tourist areas as well as the two heavily populated counties of Hillsborough and Pinellas, has about twenty-five percent of the state population.

The 2nd District contains heavily populated Duval County and about eighteen percent of the state population.

The 3rd District embraces the panhandle with its beautiful Gulf Beaches and contains about fifteen percent of the state population.

The 5th District is centrally situated – an area of tourism, citrus, cattle, and a rapidly growing permanent population in Orange County. The 5th District contains about fourteen percent of the state population.

All of the foregoing figures are from the 1950 census. Although changes in distribution have taken place, it has been largely in the direction of increasing the proportion of population in the 1st, 2nd, 4th, and 5th districts with the growth being somewhat concentrated within particular areas of each of these four districts.

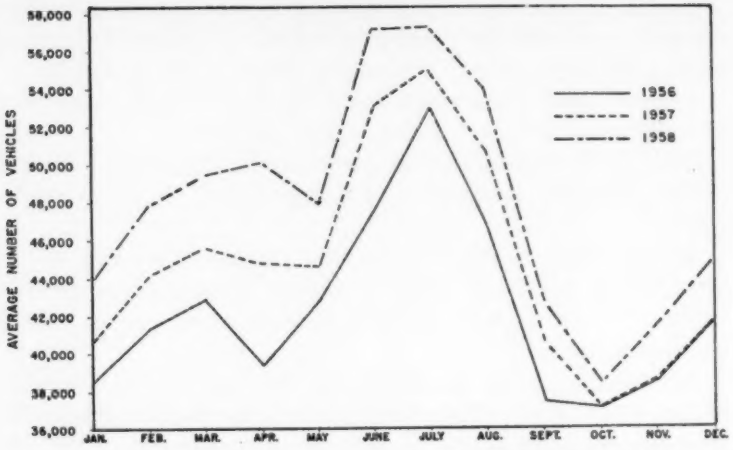
Figure 6 shows the monthly variation for the continuous recorder stations in the 1st District. Figure 7 shows the monthly variation for the continuous recorder stations in the 4th District.

The patterns of these two districts are similar. There is a high peak during the winter months and a secondary peak in the summer months. The 4th District has a more pronounced summer peak. This reflects the heavier concentration of tourist accommodations and the larger summer tourism program on the lower east coast.

The 1st District can be expected to show an increased growth during the summer months because of the great increase in tourist accommodations and a strong advertising program. These two districts contain the bulk of the tourist accommodations and are generally alike in climate, industry, agriculture and other economic factors. The traffic patterns reflect the likeness.

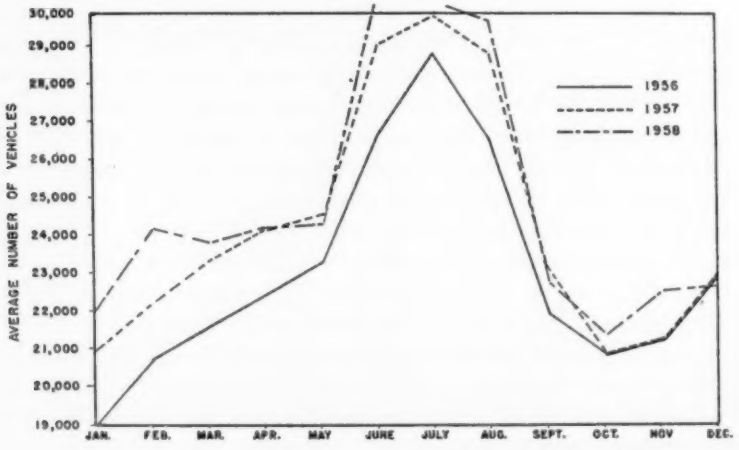
Figure 8 shows the monthly pattern for the continuous recorder stations in the 2nd District. Figure 9 gives the monthly variation for the continuous recorders in the 3rd District. The major peak in these two districts occurs during the summer months of June, July and August. There is a smaller peak during the winter months.

The 3rd District is chiefly argicultural with the exception of the Pensacola area, which is industrial, and the Gulf Beach area. The



State Road Department of Florida – 1957

Figure 8. Daily average by months of vehicles at 13 continuous count recorder stations located in the Second District.

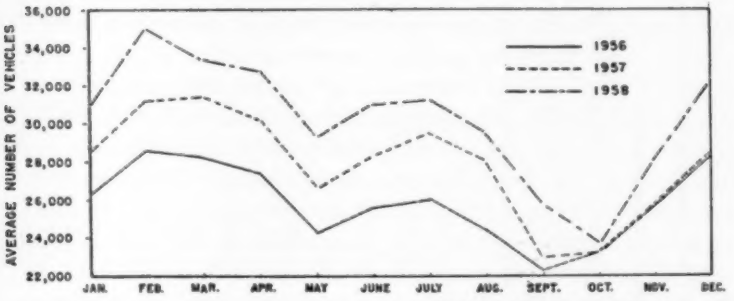


State Road Department of Florida – 1957

Figure 9. Daily average by months of vehicles at 16 continuous count recorder stations located in the Third District.

Gulf Beaches, because of their northern location, attract their main tourist load during the summer months. The minor winter peak is largely a reflection of tourist traffic in transit to and from the lower east and west coasts. The same conditions exist in the 2nd District. Jacksonville, its largest urban center, is called "The Gateway City."

Figure 10 shows the monthly variations in the 5th District. Although the peak occurs during the winter months it is not as pronounced as the two more southern districts. Figure 5 shows that



State Road Department of Florida – 1957

Figure 10. Daily average by months of vehicles at 7 continuous count recorder stations located in the Fifth District.

the 5th District is geographically located so that it contains counties with north Florida characteristics as well as counties, such as Orange, with south Florida characteristics. The monthly variations represent a good picture of the composite or transitional nature of the district.

Vehicle Classification

Table IV gives the breakdown of vehicle types by district and the state for 1957. These data were collected from fifty-three stations located at the sites of continuous recorders. The classification counts were distributed among the districts with ten stations in the 1st District, thirteen stations in the 2nd, seventeen stations in the 3rd, six stations in the 4th and seven stations in the 5th.

The proportion of commercial vehicles is about the same in the five districts. The breakdown of passenger vehicles between local

Table IV

1957 CLASSIFICATION DATA FOR 53 CONTINUOUS COUNT STATIONS LOCATED ON STATE HIGHWAY SYSTEM

CLASSIFICATION OF ANNUAL DAILY AVERAGE TRAFFIC

TYPE OF VEHICLES	*Percent All Vehicles* 1st District	*Percent All Vehicles* 2nd District	*Percent All Vehicles* 3rd District	*Percent All Vehicles* 4th District	*Percent All Vehicles* 5th District	*Percent All Vehicles* Statewide
PASSENGER CARS						
Local	50.8	44.5	35.8	61.0	45.7	50.0
Foreign	27.0	36.8	42.7	25.5	35.1	31.8
TOTAL PASSENGER CARS	77.8	81.3	78.5	86.5	80.8	81.8
COMMERCIAL VEHICLES						
2-Axle Trucks – Pick up and Panel	7.1	5.9	8.5	5.6	6.5	6.4
2-Axle Trucks – Single Rear Wheel	1.3	0.8	0.5	1.4	0.6	1.2
2-Axle Trucks – Dual Rear Wheel	6.0	4.6	5.2	4.2	5.3	4.7
3-Axle Trucks – Single Unit	0.8	0.5	0.7	0.6	0.3	0.6
TOTAL SINGLE UNIT TRUCKS	15.2	11.8	14.9	11.8	12.7	12.9
ALL MULTI-AXLE COMBINATIONS	6.5	6.5	6.1	0.7	6.0	4.6
BUSES	0.5	0.4	0.5	1.0	0.5	0.7
TOTAL COMMERCIAL VEHICLES	22.2	18.7	21.5	13.5	19.2	18.2
TOTAL ALL VEHICLES	100.0	100.0	100.0	100.0	100.0	100.0

and out-of-state varies widely among the districts. Once again the 1st and 4th districts are similar. The 2nd and 5th districts are similar while the 3rd district, which embraces northwest Florida, is different from all of the others. Almost all of the classification counts, as well as most of the continuous recorders, are situated in rural areas, and therefore do not give a complete picture.

Urban Traffic Counts

As Florida's population began urbanizing more rapidly, it became apparent that a sizeable urban counting program was needed. Some urban machine counts had been made in past years, but they were few in number, and made intermittently. Most of the urban counts were obtained as part of comprehensive urban O & D studies.

A considerable amount of thought and study was given to the size and kind of urban program that would be desirable, although at the time the State Road Department had little control or authority in urban areas. Accordingly, there was an understandable hesitancy to expend funds and time in studying larger cities.

Florida's 1955 Legislature authorized full control for the State Road Department of the urban connecting links of all state roads in all cities of the state. This made it necessary to get the urban traffic counting program underway immediately as such data were needed to plan properly for the large scale urban construction program that could be foreseen.

The regular urban counting program is composed of twenty-four-hour counts taken once each year. City limit stations which are set as part of the rural program are reset as tie-in stations to provide for continuity of relationship whenever the urban counts are taken at a different time from the rural counts for a particular area. As mentioned previously, approximately 3,000 urban stations were counted in 1957.

Future Trends

Up to this point we have discussed the counting program in Florida much as the ancient Chinese philosophers viewed life. That is, like a man rowing a boat up stream, seeing only that part of his life stream that has become history.

The ultimate justification of the counting program is not an infinite contemplation of where we have been. The justification should come from a continuing analysis of the data, to determine relationships between traffic growth and other more stable and understandable economic indices, so we can make educated guesses about what may be expected.

Before striking out boldly into the distant future let us first complete the historic picture by taking a look at the first few months of 1958.

For the month of January, the continuous recorders' composite A.D.T. showed a drop of three and five-tenths percent over January of 1957. February of this year showed a drop of eleven and four-tenths percent over the same month of 1957, while March revealed a six and six-tenths percent drop from March of 1957. This is a situation that has not occurred previously. It calls for evaluation as to whether it is due to unusual conditions or is a clear reflection of having arrived at a plateau in a matured cycle.

Closer examination reveals that gasoline consumption increased six and five-tenths percent in January of 1958 over the same month in 1957, while the continuous recorders slumped three and five-tenths percent. February of 1958 showed gasoline sales increased six-tenths percent over the same month of 1957.

This indicates that the continuous recorders do not reflect traffic changes as accurately as is desired. Most of the recorders are in rural locations and are more sensitive to tourism and winter agricultural activity than they should be. Additional stations had already been installed during the summer of 1957 within urban influences, but provide no data for comparison at this early date.

The fact that Florida suffered its worst winter in about forty years has been well publicized. Its influence on tourist traffic was extremely large. Furthermore, the adverse winter decimated the winter vegetable crops so that truck shipments and migrant worker traffic dropped to a very low level. The same is true for cattle shipments.

Perhaps to some the most surprising fact is that a tourist drop during the maximum season, estimated as high as twenty percent to twenty-five percent, did not result in a substantial decrease in gasoline consumption. The reason apparently is that the permanent population base has become so large and is increasing at such a

rapid rate that it about balances out such a large tourist decrease as was experienced during February, the maximum winter tourist month.

It is improbable that Florida will experience many such winters, with correspondingly severe winter weather throughout the areas from which the great bulk of the winter tourists come. It seems reasonable to conclude that this pause in the rapid growth of the recorded volumes will prove to be a breathing spell before Florida's rapid growth continues. Unsettled business conditions in the nation appear to have had only minor effect on traffic activity, although there are strong indications that tourists are not spending as freely as in the past.

The two other slight economic adjustments that occurred after World War II produced no noticeable impact on the growth of traffic volumes. Only the Korean War appears to have caused a one year reduction of the growth rate but not of actual growth.

Now what of the years to come? What can reasonably be expected to take place? What interpretations should be made of the historical data?

Independent authorities, such as the Bureau of Economic and Business Research of the University of Miami, Department of Economic Research of the University of Florida, the Florida Power and Light Company and the Southern Bell Telephone Company, have made population forecasts of the state of Florida. For the twenty-year period of 1955 to 1975, they show estimated increases ranging from 97 percent to 126 percent. These estimates predict a 1975 Florida population ranging from 7,040,000 to 8,400,000. Other estimates have even been as optimistic as predicting 7,500,000 by 1965. In the light of these independent forecasts, it appears that the resident population should at least double during the next twenty years.

Studies made by the Division of Traffic and Planning in connection with "Section 210 Highway Needs Studies" drew the following conclusions for 1975:

1. Driver's licenses are expected to be about 1.14 per registered motor vehicle.

2. There should be approximately 4,158,000 vehicles registered in Florida, or about 1.8 persons per vehicle.

3. Fuel consumption should more than double.

4. Vehicle miles of travel should more than double.
5. Miles of travel per vehicle are estimated to drop slightly.

These indices, and all others studied, point to the same conclusion – that Florida's present growth will continue for many years to come. Some ancillary studies further reinforce this belief. For example: a study of a three-county area along the east coast revealed some interesting facts that upset some previously accepted "truisms" of local residents.

The three counties are Dade, Broward and Palm Beach counties. These are the counties that constitute the "Gold Coast." Dade County, containing Miami, Miami Beach, Coral Gables, Hialeah, etc. is the most heavily populated of all Florida counties, yet only about forty percent of the land available for development has been used.

Broward County, containing Fort Lauderdale, Hollywood, Dania, etc., is the fastest growing county in the state. It has developed about thirty percent of its usable available land. Palm Beach County has only used about forty percent of its available land.

Thus, even in the most heavily settled region of the state, there remains more available land than has so far been used. This is contrary to most local assumptions. The rest of the state shows even more elbow room available.

In the past, the development of manufacturing has not been as significant as might be expected. The existence of the large and rapidly growing permanent population has begun to stimulate the growth of a large amount of light industry including clothing, light metal fabrication, and electronics. Florida's climate, increasing population and the availability of large numbers of skilled and trained people have helped to accelerate industrial growth.

Tests of responses to employment advertising listing Florida openings as well as those in other parts of the country, showed a much higher response to Florida vacancies than elsewhere.

As a result many companies, competing for employees with short supply skills, are finding it possible to obtain the desired help with plants in Florida. Many of the larger companies now locating in Florida attract satellite suppliers. The growth of this desirable type of industry is increasing rapidly and should continue to do so.

Nearness to South American markets has further attracted com-

mercial and industrial organizations. Florida appears to be potentially a major gateway of commercial and industrial intercourse with South America. Plans are under way for the establishment of a large Inter-American Trade Mart in South Florida which will support this trade.

Many studies indicate that Florida will continue to be a goal for retiring people. With the growth of numerous retirement plans to supplement social security, the pool of potential retirees who can afford to retire in Florida will be large. The number who actually move to Florida will depend not only on the general economic climate of the United States but also on the ability of Florida to accommodate increasingly large numbers of elder citizens. Recognizing this situation, the state, studying the problems involved, is developing programs tailored to attract older persons who wish to fulfill their dreams by retiring in the sunshine state.

Our problem in Florida may well turn out to be "Can we plan rapidly enough and soundly enough to avoid the great dangers of uncontrolled growth?" If not, we may destroy the environment that now makes Florida appealing.

It is certain that an increasing portion of the counting program will be in urban and semi-urban areas. Extensive new construction, combined with saturation on some old routes, will continue to make obsolete some locations and necessitate a continuous study of the sampling procedure.

Finally, continual change and improvement in instrumentation will provide better data in more easily usable form. We have obtained satisfactory performance, both in accuracy and maintenance, from an experimental urban location, using radar detectors connected to R.C. type portable counters. The performance of this installation has convinced us that a similar type installation is economically justifiable and of superior performance for very high volume locations throughout the state. Some trial installations of counters connected to signal controllers at actuated installations are planned, although there is some doubt as to the usefulness of the information since it is likely that such intersections will be operating at capacity under heavy traffic pressure.

Entering of data directly from counters, both automatic and hand, on punched paper tapes and magnetic tapes is a probable

future development. This will permit greater use of integrated data processing and of electronic computers.

A sober review of all indices points to the conclusion that Florida, and its traffic, will continue to grow at a faster rate than in other states. If historic trends are of any value in predicting future behavior, Florida should plan for a doubling of population and traffic within the next ten to twenty years.

Shopping Center Design

LATHROP DOUGLASS

Mr. Douglass, an architect with offices in New York City, has designed twenty-five shopping centers, two of them having areas of one million square feet each. He was the consulting architect for seven other shopping centers. He is also widely experienced as the architect for department stores, office buildings, industrial and residential projects. Mr. Douglass is a member of the American Institute of Architects; of the New York State Association of Architects; of the American Society of Civil Engineers, and of the Urban Land Institute. He served as a United States Delegate to the ninth Pan-American Congress of Architects at Caracas in 1955. Mr. Douglass received a First Medal Award at the Festival International d' Architecture et d' Art at Paris in 1956. He is the author of articles in professional magazines on planning and economics.

TODAY'S preplanned shopping center is a recent phenomenon in America and practically unknown elsewhere. Inevitably, it was necessary to plunge into the planning of these centers long before any really adequate operating experience was available to aid in setting up standards and criteria. But one thing appears certainly true – the large shopping center in America is everywhere having a tremendous impact on the community.

Customers spend as much as $50,000,000 a year in a single center. This is money that would otherwise have been spent downtown or with the independent-store "taxpayers" of the neighborhood. From the physical point of view also, the impact is tremendous. On any busy day customers drive 20,000 cars or more to just one of the major centers. This many cars in a single moving line on U.S. Highway 1, for instance, would stretch from New York to Boston!

In analyzing this phenomenon, two facts are perhaps more basic than others. First, the shopping center is built for one purpose and one purpose only – the sale of merchandise so that both the developer and the tenant stores can make a profit. Because the rents are based on percentages of the gross sales of all the stores, the developer can profit only if the tenants make the sales. Second, the shopping center, to achieve its maximum potential in sales and

profits, must be planned as one vast, perfectly integrated pattern of circulation – both vehicular and pedestrian.

Assuming, therefore, price and scope of merchandise that will adequately attract the buying public, one can conclude that careful planning of the circulation, outdoors and within the stores themselves, makes the actual sale of merchandise possible and thereby promotes a profitable operation.

The type of lease, cost of construction, extent of mortgage, general charm, and advertising appearance each has its essential role in this jigsaw puzzle. But goods and circulation are basic. It should perhaps be axiomatically said that any shopper will go wherever she can get what she wants, when she wants it, and with the least possible inconvenience to herself.

The housewife leaving her home by neighborhood streets must turn on to a major highway, turn off the highway on shopping center approaches, follow the "ring" road to the center's periphery and pick the parking area nearest to the first store she wishes to enter. She must drive along a parking lane to an empty stall, park her car and then proceed on foot to one or another group of store buildings. Here she has the choice of entering a store directly from the parking area, or of proceeding through walkways to a long pedestrian mall that is the core or backbone of the project.

Once within the mall, she strolls along a tree-lined, landscaped pedestrian "shopping street," pausing to look in windows of different stores from one side of the mall to the other, until she reaches the store of her choice. Inside the store she again follows carefully planned circulation of the aisles, past strategically placed show cases displaying "impulse goods," and on perhaps to the centrally located vertical circulation. Here she moves up an escalator looking out over the array of merchandise and again enters the planned circulation of aisles between the counters until she reaches the place to buy her stockings, refrigerator, hairpins, or mink coat.

Then, remembering other needs and also the provocative displays in various counters and store windows she has passed, she moves on through other planned pedestrian routes to spend an hour, perhaps half a day or more in shopping. This is called "one stop" shopping.

Every road, every walk, every shop location and store aisle is planned to expose the shopper to the greatest possible amount of

merchandise and to influence her to spend her shopping dollars. At last, with an empty purse she heads homeward, tired (and we hope happy) taking with her everything she needs, and (as the developers hope) with little money left to spend elsewhere on other things.

Just as the proper kind of merchandise is vital, so too is the proper planning of circulation: not only the highways or the parking bays but every aspect of the shoppers' route. The handsome proportions of the buildings, the brilliant signs, the gala show window, the pleasant charm of landscaped mall – all do their much-needed share. But getting the customer *conveniently to all the merchandise* and back again, however, is in reality the basic problem of the design.

Important Factors in Center-Planning

The computed size of any trade area is in direct proportion to the size of the proposed project and type of stores that are to be its tenants. What it has to offer is measured primarily in "name" stores and "breadth" and "depth" of merchandise.

White Plains, the center of Westchester, though merely an unplanned suburban town, draws a tremendous number of customers from far away simply because it offers many well-known stores selling every conceivable type of merchandise. Nearby Cross County Center is a planned shopping center of a million square feet, two major department stores and many well-known chains. It also draws customers from far away – often twenty miles or a half hour's drive or more.

On the other hand, the typical small neighborhood center with a supermarket as its principal attraction, supplemented by a drug store, a five-and-dime, and a few service stores, will draw only from the immediate neighborhood – that is, a mile or two away. Store customers come to this type of project only to buy daily necessities. They are in a hurry, park a few minutes, and are gone. Long walks from the point of parking are detrimental, and internal landscaped malls only serve to increase the distance to the car. The customer is going to buy only a tube of tooth paste or other toiletries. All the planning criteria of the one-stop regional shopping center are irrelevant.

For example, one small neighborhood center was originally

planned with a landscaped court in the center, stores on three sides, and parking areas surrounding the store group. This center met heavy competition from typical taxpayers down the road. Although it seemed a pity to sacrifice the charming little central court of grass and trees, planners recommended turning the court into a parking lot so customers could park at the curb in front of the store they were heading for. Immediately business picked up.

The exact reverse is true, however, in a large regional type of center. Here the parking areas are unavoidably extensive and the customers may stay for hours. Even here the average customer will object to walking over a few hundred feet from her car except during the Christmas season; but the centrally located, attractively landscaped mall is in reality the shopping center of the project and becomes the center of serious and prolonged shopping activities. For this kind of shopping the customer therefore walks farther, takes more time, and spends more money.

In general, the larger and more powerful the agglomeration of well-known stores, the greater the trade area that can be counted on, and – subject to the effect of existing and possible future competition – the greater the potential total sales. More than one center has been in financial trouble because of the lack of enough well-known stores to draw sufficient trade.

Access and Circulation Essential

With reference again to the circulation problem: A trade area of a million means nothing, if too much time and trouble must be spent in getting to the project. A large percentage of people will drive five or ten minutes to do their shopping. A smaller number will drive fifteen or twenty. A few will even drive an hour – if the route is direct and the hazards few. But where roads are narrow and congested, time-consuming and inconvenient for the housewife, she will unfailingly go elsewhere to do her shopping. And who can tell how many millions of dollars of potential sales are lost each year this way?

Therefore, regardless of the population or income figures of a trade area, the only thing that really counts is how many of the people in this assumed trade area can actually get to the center conveniently and in a *reasonable amount of time.*

It is customary to say that a center should be built at the intersection of the two major highways to provide access from all four compass points. But a location at the intersection may have its complications too. A major or limited access highway is for high-speed traffic; the design emphasis on keeping through-traffic moving without loss of speed requires a complicated system for getting on or off. The necessary clover-leaves can seriously complicate the ingress and egress from the shopping center.

Again, with reference to Cross County Center, despite its magnificent surrounding highways, the actual entrances to the project itself are seriously complicated by the vast network of traffic interchanges. Even when the access situation appeared adequate, more than one project has been damaged because of increases in the scope and area of interchanges subsequent to construction of the project.

As highways are intended for the general public and not for the express benefit of commercial enterprises, it is only reasonable that high-speed traffic should be given the advantage over local traffic coming in and out of any shopping center. Inevitably, the question arises as to whether shopping centers would be better located a short distance away from major intersections – near enough to benefit from visibility but far enough away to avoid the geographical complication of high-speed interchanges.

If it is not easy for the housewife to find her way into any center, she will give up and go away. Meanwhile, the project's owner will blame the stores, the business cycle, the architect, the economist, or any other handy target rather than face the less obvious but more probable reason: that the female shopper has found it too hard to find her way through the complicated maze needed to maintain proper traffic speed.

A case in point is Mid Island Plaza in Hicksville, Long Island. Access routes into the project from the highway are adequate, and properly designated for the traffic load. But customers coming from the southerly parts of the estimated trade area have to go through a traffic bottle neck in the immediately adjacent town of Hicksville. In the author's opinion, this bottle neck deprives Mid Island of a large segment of potential customers, but whether the loss stems from traffic congestion rather than from competition cannot be accurately computed.

The same problem occurs in more detail at actual entrances to a project site. This is the next critical point of design. Simple, direct, and easily understood routes for shoppers would be ideal. But these would, of course, require traffic lights and left turns and other devices frowned upon by traffic engineers.

Designing for Shopper-Preference

It is difficult to argue against the traffic efficiency and against the rights of any community, but the architect for a project cannot help visualizing the potential loss in sales because the housewife finds it easier to go somewhere else. If the stores are famous and popular enough, this point may not be significant. But in the steadily mounting competition between shopping areas, one cannot afford to lose a single trick.

Does the shopper prefer a circuitous route on which she can keep moving – or does she prefer to see her destination, turn left to proceed left and wait at traffic lights to achieve this more direct access? Perhaps there are statistics on this. If so, they should be broadly publicized.

The author was taken for a tour of a large center by an executive of one of its tenant stores. On leaving the project at the end of the day, the executive turned into a road marked "Entrance Only." When asked why he did not use an "exit" route, he said, "Oh, I always go out this way; it's too much trouble to find the exit road." Again – at what point does irritation begin to hurt potential sales?

Once inside the confines of the regional type of center – one with a parking capacity for 15,000 or more cars – the would-be shopper usually heads for the store she originally had in mind for her first purchase. To facilitate this aspect of the flow of traffic and keep it from becoming too concentrated and congested in the immediate environs of the stores, it is now generally customary to provide a basic peripheral circulation around the outside of the parking area, usually referred to as the "ring" road. The parking lanes take off from this road and lead toward the centrally situated store group.

The ring road again raises the question of convenience and customer irritation. As previously stated, it is important that all traffic

routes be adequate not only for efficiency in handling traffic but for ease of comprehension by the shopper. And to these two criteria must be added a third – the traffic pattern should not give certain stores advantage over others. The layout of the various stores is carefully planned to give each one an even break, to make it as easy for the shopper to spend her dollar in one as in another.

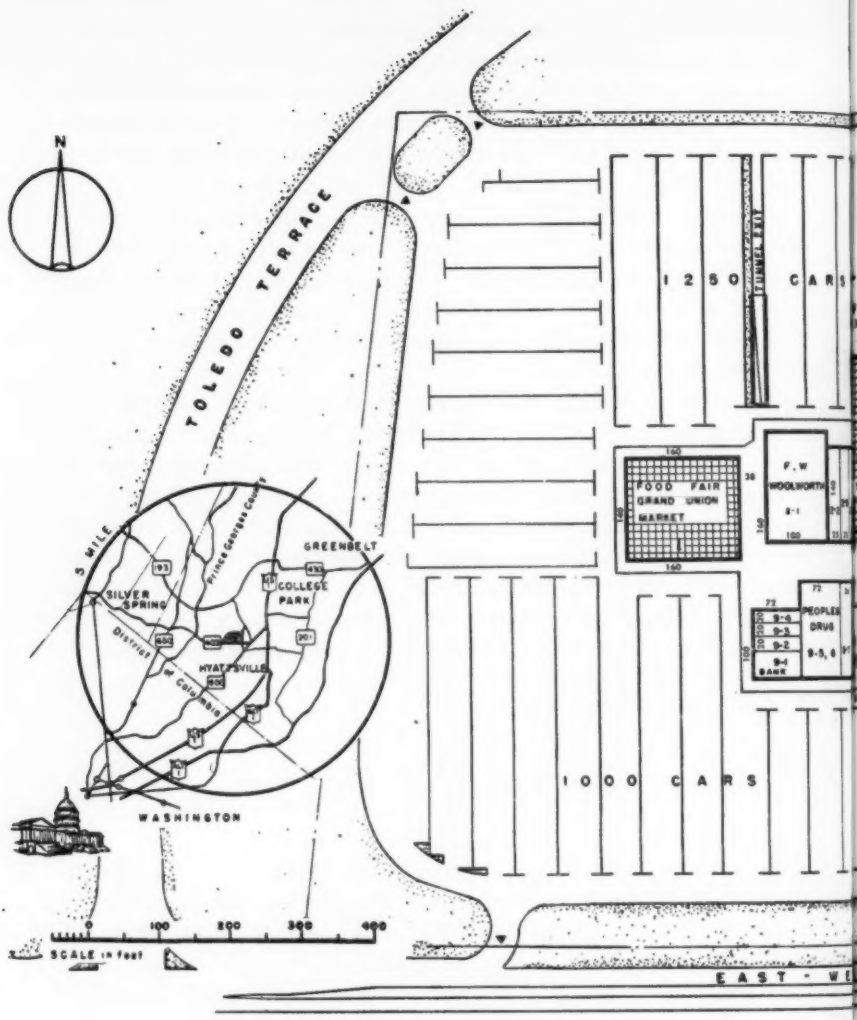
Large and strong stores are put at strategic points to generate pedestrian traffic past the weaker or smaller ones. In this way the whole center benefits. Obviously, no shopping-center owner would benefit from a situation in which some part of the project would never get customers. So the ring road and basic parking pattern must be fair to all.

Efficiency of traffic movement might often be best served by a one-way system; but the pattern of entering cars would then favor one side of the project or another, and hence one certain group of stores or another. In the case of one large project in the New York area, where its major department store was able to exert considerable influence in the site planning, the road pattern has worked out so that the unsuspecting customer inevitably finds herself in front of this particular department store. The author has visited the center many times and still finds himself often as not ending up in front of this department store. This situation is not conducive to the overall success of the center.

Experts Disagree on Parking Patterns

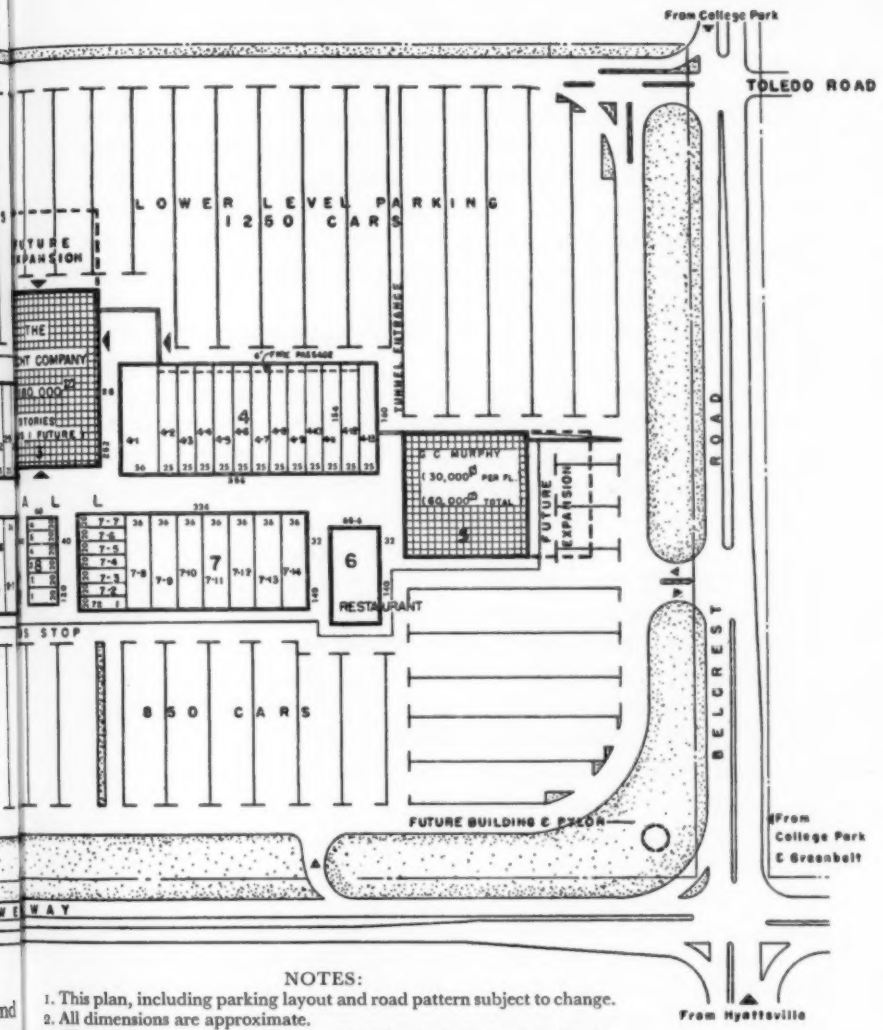
Concerning the actual parking pattern itself, there is substantial disagreement among experts as to what patterns best serve the purpose. The argument about parking at ninety degrees, or at some easier angle such as forty-five degrees, has been going on for years. Based on personal experience, it is the author's opinion that arguments for the ninety-degree system considerably outweigh the others. It is obviously easier to make the turn into a stall at forty-five degrees to the line of travel. But from every other point of view the requirements seem to be in favor of ninety degrees.

In the first place, at ninety degrees all travel throughout can be two-way so that the shopper is able to go in any direction to find a parking stall, or to start on her way home. She is not forced into an



Prince Georges Plaza, Prince Georges County, Maryland

Parking for approximately 4350 Cars. See Note 3.



NOTES:

1. This plan, including parking layout and road pattern subject to change.
2. All dimensions are approximate.
3. All spaces subject to reduction caused by legal exit passages, stairs, fire walls, and any other requirement of building laws, shafts and furring for mechanical equipment.
4. Lower Level parking may be increased by future multiple decking at owners' option.

unnecessarily long and often confusing one-way pattern. Furthermore, it is easy to maintain order in a ninety-degree system simply by painted lines to show the car stalls.

In a forty-five-degree system, on the other hand, if physical barriers or bumpers are not installed between the lines of parked cars, the discipline of the painted lines breaks down and the whole pattern tends to get out of order, reducing capacity and creating further confusion. If physical barriers are installed, the shopper not only must follow long one-way routes but the barriers prevent her from making logical short-cuts when the parking lots are partially empty. To these objections must of course be added the increased problem of snow removal.

Recently, the author accompanied some visiting department store executives on a tour of the large shopping developments around New York. During the trip to a large center in New Jersey, the advantages of ninety-degree parking were discussed. On reaching this new project which has forty-five-degree stalls, we found ourselves constantly in the wrong way lane and finally ended up completely lost in the labyrinth of one-way routes. My friends thought I was deliberately trying to put a point over, when in all honesty I had done my best to follow directions and avoid getting lost. It is interesting to note that the owners of this project have now decided to change the pattern to ninety degrees.

The basic question is, of course, whether or not the ease of actual parking at forty-five degrees or sixty degrees outweighs the frustrations, confusions and loss of time. Perhaps a survey to find a factual answer for this point has been or will be conducted.

Split and Double Parking Levels

In regard to the vehicular aspect of shopping center circulation, it may be pertinent to mention split and double levels of parking. In a densely populated, high land-value area, it makes sense to double deck the parking, to save land and at the same time shorten the walk from cars to stores. But many times the parking lot, though on a single plane, is split in two levels: for instance, the major portion is at one level, but the department store has a secondary depressed area that connects directly with its basement.

Wanamaker's, in Cross County Center, has three such levels. Nevertheless, in the *average* center, large or small, the merchandising is at *one* level except for the department store and possibly the basements of a few other major units. Invariably, the department store management believes it can develop greater basement sales if the basement area is accessible directly from the parking without use of escalators or stairs. There is no question but that this is true.

On the other hand, suppose a customer takes this lower level because she wants to buy some item from the basement store. She parks on the lower level, enters the basement and makes her purchase. When leaving the department store, however, she is on a different level from the other stores. Isolated from them topographically and visually, as a result she leaves directly without buying anything from the other stores. Potential sales are lost and the financial soundness of the center damaged.

Sometimes split-level parking is introduced because the site is irregular or sloping. Then it is either a case of split-level parking or an enormous amount of grading to produce a single-level project. Problems of this kind challenge an architect's ingenuity, so he sits up nights working out some split-level solution that eliminates extensive grading and produces an interesting mass effect. But this approach is not based on sound reasoning.

The purpose or raison d'etre of the project is the profitable sale of merchandise. And any factor that injures the merchandising soundness of the plan, or favors one part of the project over another, or in any way interferes with the convenience of the shopper, is detrimental to the financial status of the enterprise. One current regional center project required the removal of 1,000,000 cubic yards of earth in order not to break up the continuity and single level of the parking area. In this era of competition it is better to spend the money on earth-moving than to risk losing sales.

Service Roads and Tunnels

Shelves and stockrooms of shopping center stores must be kept full for today's suburban customer who enjoys the advantage of taking home her purchases at the time of purchase. Also, the accumulating debris of empty packing cases, trash and garbage must be removed

each day. To accomplish these necessary functions considerable daily trucking is required and the conscientious planner works out ingenious systems of truck routes and loading docks, tunnels and service yards.

But too often one finds the situation of the tail that wags the dog. The project is not a trucking enterprise – it is for the purpose of merchandising for a profit. Compared with a normal city street the total number of trucks is negligible, and the majority usually arrive in the morning when customer traffic is low. In a large-sized project, perhaps fifty to one hundred trucks may arrive a day. This is no traffic hazard. Unnecessary space set aside for separate truck routes and other facilities merely takes up land where customers could park.

Convenience of the customers and not the truckers is necessary to the project; so also with loading and unloading facilities. The sight of trash and dirt and ugly debris can harm the appearance of a project and seriously impair its business volume. Therefore, there must be service courts to conceal the trash, strict project regulations on concealment of debris within the stores, or separate service tunnels to keep all this activity completely out of sight. These are necessary adjuncts because they affect the public and aid the sales potential, not because they aid the trucker.

A service tunnel costing from three to five percent of the project's overall construction cost may well be justified. It improves project prestige and aids attractiveness. For these reasons it puts the project in a higher class and hence promotes a higher rental schedule. It even makes possible the profitable rental of much more basement space.

But these facilities, for financial soundness, must be kept to absolute minimum standards. Elaborate trucking docks, for instance, are expensive. They make it easier for the trucker, but they do not increase sales. Literally, one cannot afford and should not provide facilities in excess of the minimum required to do the job. The emphasis must always be on the customer – her comfort, her convenience, her psychological reaction to attractive buildings, exciting show windows, and colorful flowers and trees.

In fact, too often money is spent on expensive construction that does not show or on unnecessary facilities, only to have the project end up with the need for drastic, last-minute economy that fre-

quently takes the form of slashing the landscape budget and cheapening visible, exterior materials. This the poorest kind of economy since landscaping particularly is something that appeals to the average customer. She has a garden of her own and feels happier, more relaxed, and more in a buying mood if she is surrounded during her shopping excursion with flowers, trees and grass of a handsomely landscaped mall.

Here, the extra maintenance and extra expense are an asset rather than a liability. A few cents a square foot saved through careful study to achieve economies in floor and roof construction, for instance, will easily pay for enough landscaping and other customer amenities to produce a truly appealing project. It is far better to spend the money where it can be appreciated.

Achieving Unified Shopping Areas

Once the housewife parks her car in the circumferential parking area of a regional center, she heads normally for the project's mall or core, the shopping street that is, the concentration of all store entrances. To reach this mall she usually has the choice of entering and going through one of the larger stores, or, preferably, of going along a twenty- or thirty-foot wide access walk between buildings to the mall. It has been fairly well established that she will walk through a large store to reach the mall but that she is generally shy about using one of the smaller, narrower stores as a passage to the pedestrian shopping street.

It is axiomatic that all forms of steps or abrupt grade-changes should be avoided in any shopping route. But interestingly enough, so long as the shopping mall itself is approximately level, people do not seem to mind going up or down a few feet to attain this level. This fact sometimes permits putting the whole group of buildings on a pedestal, as it were, three or four feet high. Besides construction economy, this plan also has the advantage of making the buildings, their signs, and those show windows facing the parking lots, more visible from the surrounding roads.

Another curious fact is that shoppers seem always to prefer going down empty-handed to a basement store and carrying their purchases up, rather than going empty-handed to the second floor and letting gravity aid in carrying down the packages.

Inside the mall, on the shopping street itself, nothing should interfere in the slightest way with the shopper's convenience or her safety. The basic goal in planning is to create the simplest, most straightforward, most unified concentration of shopping possibilities that can be achieved. All stores should be within view of all the shoppers: and no store should be at any disadvantage from another, either as to accessibility or visibility.

There are many ways of achieving this aim. It is obviously no problem in the little neighborhood center of a dozen stores lined up in a row with the parking lot in front and trucking to the rear. But in a large regional center, where traffic and merchandise problems are more complex and the areas involved are so much greater, the means of achieving this unity and concentration of shopping is more difficult.

Some experts advocate a single narrow pedestrian mall, with stores on both sides and with important units – having strong, customer-drawing power – at both ends. Others prefer putting the major magnet, usually the department store, in the center, with the next strongest units at the ends. In the so-called cluster plan, the department store is largely or completely surrounded with smaller stores, so that everyone, in order to reach the department store, must go by and hence be exposed to the smaller units.

There are many variations of these two basic regional types – some with cross malls, partial malls, and even double-decking of all stores to concentrate the shopping and reduce walking distances. All other things being equal, my preference is the single straight-line mall, fifty to seventy feet wide. It is familiar to everyone because it resembles a city street. With no more than seventy-foot width, it is possible to show windows easily on both sides and to shop back and forth from one line of stores to the other.

And perhaps, more than in any other scheme except that of the simple strip of stores, the customer can grasp the scope of available shopping. She can readily see where she must go to obtain her needs. It is the same theory of directness, compactness and simplicity that should apply to all aspects of the project.

Attractiveness of the mall, a most important feature from the customer's point of view, is created by good landscaping and good building design. Comfort and convenience, also important customer requirements, are attained through such facilities as con-

tinuous, column-supported, or cantilevered canopies to keep out sun and rain, benches to rest on, play areas for children, and many other items. Sometimes the entire mall is covered with a roof so that the shopper can walk from one store to another – in winter-heated or summer-cooled surroundings. Handsome show windows and well-designed store signs designating the major stores play important parts in customer-inducement.

But above all things each store must have an *equal chance*. This is mandatory because, as previously stated, the rent *paid by* each tenant is customarily based on a *percentage of his gross sales*. Hence, the owner's profit depends directly on the sales volume of the project or the sum of all its parts. Next to a simple, unified concentration of pedestrian circulation, the best way of achieving this balance, or equal opportunity, is through carefully studied placement of every store in its relationship to all the others. Actually this is, again, a concentration problem.

Generally speaking, the larger stores attract the customers. But if the customer can be induced to pass the smaller stores en route to the larger ones, her instinct for comparison shopping, plus the natural effect of impulse buying, will cause her to enter these stores also. The circulation pattern therefore is worked out by placing the larger or stronger stores at strategic points and filling in between with smaller stores.

Usually the department store has the greatest drawing power, and is generally placed in the center, or at one end. Next, in order of importance, comes the market which draws a great volume of customers, though mostly from the immediate neighborhood. Then the junior Department Store, the five-and-dime or variety, the drug store, restaurants, smaller apparel stores, and so on down the list. Because customers will always come to "big name" stores, these big name chain units are tough bargainers and the rents they pay are therefore low. It is the small but actually more profitable stores whose trade must be assured by careful balancing in the site planning.

Three Basic Factors in Center-Planning

Once a shopper has entered her favorite store, the circulation problem continues in principle to be the same. A piano or fur coat is usually not an impulse item. The customer has entered the store

specifically to buy such an item – so this type of merchandise is generally put in the more distant corners or upper floors.

This strategy, in turn, forces the customer to walk along aisles that pass innumerable articles – articles that she might need, but could easily fail to buy if not reminded of them by their presence in nearby attractive counter displays. Very heavy volumes of sales, as a result, are usually rung up around the main entrance and along the routes to escalators – assuming of course proper planning and right type merchandise for these locations.

These points merely emphasize, once again, the basic concepts upon which shopping centers flourish: *first, the type and variety of merchandise*, enhanced of course by well-known store names, attractive displays, and other supporting factors; *and second, a circulation system both vehicular and pedestrian planned to expose the customer to this merchandise in the most convenient, compact way that ingenious planning can devise*. This double appeal is then immeasurably strengthened by the impact of handsome buildings, the pleasing character of gardened malls, restrained use of signs and all the little items that add up to a large total of customer satisfaction and convenience.

This article has been primarily concerned with planning. Lest this aspect of the customary program be over-emphasized, it seems appropriate to bring up another basic factor, that is, the *financing* of a shopping center, for without financing there can be no center. The maximum mortgage obtainable is based normally and principally on a multiple of the total sum of the minimum rents of all the stores, as established in the leases.

In other words, the cost of construction does not normally determine the amount of loan. The leasing brokers negotiate the rents and set these up in rent schedules. The financing institutions then make their commitments upon these rents and tenant credit ratings. The construction cost budget is thus irrevocably established.

There is but one thing to do. The architect must design the project within this budget and the project must be built within this budget. Otherwise, there are almost always insufficient funds for the program to proceed, and the careful planning of highways, parking lots, malls and stores can turn out to be of no avai!. Like many a hopeful concept in this field, the project would then have died.

Parking in Miami Beach

MORRIS N. LIPP

Mr. Lipp was appointed by the city council as City Manager of Miami Beach on March 1, 1958. He had served as city engineer since 1953 and as assistant city manager since 1952. He has had 32 years' experience in solving municipal engineering problems. As city engineer, Mr. Lipp is credited with correcting several difficult situations in Miami Beach, including those of beach erosion and sewage disposal. He is an outstanding authority on beach preservation. He also has been directly responsible for $30,000,000 in civic improvements since World War II. During the war, Mr. Lipp was a major in the U.S. Army Corps of Engineers. He is a member of the Florida and Federal bars, Florida Engineering Society, American Society of Civil Engineers, and a director of the American Shore and Beach Preservation Association. He is the author of several treatises on various engineering subjects.

MIAMI BEACH, an eight square mile, sub-tropical vacation island, is dependent economically upon the 1,500,000 tourists who visit it annually. Tourist trade is its only industry, and a major portion of its promotion and advertising emphasizes relaxation, recreation, and freedom from ordinary cares and worries.

Inadequate parking could, therefore, be more than merely annoying. It could strike at the city's tourist economy by curbing its stream of visitors. The overall parking problem in Miami Beach has been similar in many respects to other American cities. The causes and effects, of course, have been almost identical.

As in many other urban areas, Miami Beach has experienced the acute need for greater parking facilities to meet demands of a vigorously expanding economy and increasing population. (Compounding this aspect of the problem is the fact that Miami Beach triples its permanent population during the height of its tourist seasons.) Miami Beach also has faced the similar difficulty of finding land and money to satisfy these demands.

Fortunately, Miami Beach has been able to keep pace with its parking needs and currently is embarking on an expansion program to meet future requirements. This accomplishment is attributable to various factors – long-range municipal planning, financing methods, efficient operation, and a co-operative community.

The principal feature of this resort city's successful parking system is its municipally-owned off-street parking areas. Miami Beach is one of the pioneers nationally in this field and is the first Florida city to gain statutory approval for its off-street parking program.

Planning Began in Late Thirties

The city's parking plan was conceived during the late thirties, when there were strong indications that Miami Beach was surging towards its present preeminent position in the resort industry. At that time, construction activity by private enterprise was setting records and the challenge for increased parking facilities as well as for municipal services, civic improvements, and other traffic needs gave Miami Beach officials their first experience of what the post-war period would bring.

The parking plan began modestly, with the purchase of fewer than 200 meters in 1938. In 1940, the first off-street lot was developed on city-owned land to serve its main shopping center, Lincoln Road. This pilot area was constructed in a crude manner and provided space for fewer than one hundred vehicles. In 1942 an area was developed for the accommodation of bathers at the south end of the city on an ocean front tract. These two areas were financed with current funds.

Naturally there was no expansion during the war, but in anticipation of post-war work, funds in the amount of $300,000 were raised by general obligation bonds.

At the cessation of hostilities, work was again started with certain areas developed by current funds and others by general obligation bonds. However, it was immediately recognized that the surface was only being scratched, and still further enlargement, particularly city-wide, was necessary. Studies indicated that a proper system would require the purchase of expensive improved properties.

Financing the Program

Because of the magnitude of the program, financing by current funds was out of the question. Procedure with general obligation bonds had its limitations. This type of issue requires a bond election by the registered freeholders, and the state constitution provides

that more than fifty percent of them should participate and that a majority of the participants be favorable. It was realized that in this fast-growing community it would be necessary from time to time to install various types of municipal improvements that could be financed only by general obligation bonds. These bonds tend to increase the tax rate. Our policy in rising costs of government has been, where possible, to avoid tax increases; and it was therefore decided to pursue the problem from the standpoint of a self-liquidating issue.

Preliminary studies indicated that this approach was feasible, and in 1949 an enabling act was adopted by the state legislature. In 1950 the issue was validated by the Circuit Court in Dade County, Florida, and subsequently approved by the State Supreme Court. The issue was in the amount of $1,480,000. Bonds in the amount of $750,000 are term bonds due in 1975. They are also callable. Bonds in the amount of $730,000 are serial, being due annually commencing in 1952 and ending in 1974. Both types of bonds were sold at par with the serial bonds having an average interest rate of 3.03 percent and the term bonds 3 percent.

The most important feature of the bond agreement is that redemption is to be effected by revenues from all parking meters throughout the city – those located on streets as well as those in the off-street parking areas.

All income and revenue derived from operation of the parking facilities are periodically deposited in the following funds:

1. Operation and Maintenance Fund: Monthly deposits in amounts sufficient to pay for the reasonable and necessary expense of operating and maintaining the system including the cost of repairs, renewals and replacements.

2. Bond Redemption and Interest Fund: Monthly deposit:

   a. Sufficient to pay the interest and principal;

   b. In addition, a reserve account in the amount of $2,500 for each month. When this reserve account reaches $150,000, it is mandatory that the accumulated excess over that amount be used on the next interest payment date to call and retire outstanding bonds.

3. Renewal and Replacement Fund: Monthly payment of $833.33 until such fund shall be $50,000 or 30 percent of the aggregate cost of all parking meters, whichever may be the greater.

Money in this fund can be used for making major renewals, replacements and repairs to the system, the cost of which can not be properly classified as normal operation and maintenance expenditures.

4. Surplus Revenues: Whenever all required payments into the several sinking funds are current, all remaining revenues at the end of any sinking fund year shall be regarded as surplus.

It is mandatory that one-third of such surplus revenues shall be used to retire, in advance of maturity, bonds payable from the bond and interest redemption fund, either through purchase in the open market or through call for redemption. The remainder of such surplus may be used by the city to extend or improve the system or to retire bonds in advance of maturity.

Other covenants in the bond agreement worthy of mention are as follows:

1. The preparation of an annual inventory report.
2. An annual audit and engineering survey.
3. The appointment of a manager of the system by the city.
4. Preparation of an annual budget.
5. That the city maintain the system in good repair and working order and operate it efficiently.
6. That the city carry adequate public liability insurance.
7. The city may only dispose of property when it has become inexpedient in connection with the system because other property of equal value is substituted therefor.
8. The city may lease to private operators any part of the system other than city streets, under such provisions designed to assure an adequate income therefrom as may be considered feasible by the city council and consulting engineer. At present the city does not contemplate leasing any of its property.
9. Changes in meter locations are permitted when necessitated by street widening or to provide essential and necessary traffic regulation and control, provided there will be no material decrease in revenue.
10. In the event of default, the system is to be managed by a consulting traffic engineer.

One of the early steps in effecting the program was the appraisal of property to be acquired.

Most of the property was acquired by negotiation. The general procedure was to offer the appraised value plus ten percent. The ten percent was not in the nature of a bonus, nor did it constitute additional expense to the city. This amount, in the event of condemnation, would have had to be paid by the city in legal fees, etc., to the property owners.

Off-street Areas Fully Developed

All the parking areas are fully developed with adequate drainage, surfacing, lighting, walks, landscaping, and walls for the protection of adjoining properties.

Naturally each lot has been designed to meet economic, setback, and space conditions. Consideration has been given to the limitations of individual drivers. Generally parking is at a 45-degree angle. Economic planning in certain lots has resulted in right angle parking; and in others, lanes of parallel parking. In some cases one-way movement has been the consequence of space limitations.

In the land purchase of certain off-street parking areas, particularly in congested business areas, consideration was given to ultimate multi-level decking. In the initial development, designs were prepared so that additional decks could be constructed with a minimum disturbance to street level facilities.

In all off-street areas, meters operate around the clock seven days a week.

Although on-street meters have been placed generally only in business areas, it was found desirable to place some of them on ocean front streets in the central hotel area because of serious congestion, which made some of the streets difficult of passage. These particular streets are provided with 18-hour meters as compared with the customary one and two-hour meters on other streets.

Off-street parking areas have from two to eighteen-hour meters, depending upon desired time. Permits can be obtained for annual parking in certain off-street areas for $72. These permits may also be obtained on a semi-annual basis – $45 for the winter six months, and $27 for the summer.

The completed off-street areas are well dispersed throughout the city, close to the various business areas. To date, the parking

areas have been restricted to serve that type of area and none has been developed for the purpose of directly providing parking for hotel, multiple-family or single-family residential areas.

The principle behind this policy is that the public at large should be served initially. Naturally, the system may in the future be expanded into multiple-family areas. The general public will under these circumstances benefit by relief of congestion on the city streets.

Rapid Growth of System

The program as originally contemplated was not only completed in a short time, but was so successful that many extensions have been made in accordance with the bond agreement. Those permitted by the surplus revenue covenant amount to $1,448,000. In addition, $980,000 in bonds have been retired or redeemed prior to maturity.

The following table shows the expansion of the metered parking system:

	Number of Meters					
	In Operation Jan. 1		*Daily*			
Year	*On-street*	*Off-street*	*Average*	*Total revenue*	*Operating costs*	*Net revenues*
1951	2165	1366	3672	$217,756.54	$32,857.04	$184,899.50
1952	2201	1550	4221	262,148.72	36,748.76	225,399.96
1953	2449	2109	5470	361,880.77	42,100.83	319,779.94
1954	2936	2899	6068	448,611.35	53,716.07	394,895.28
1955	3615	3173	7128	622,666.39	64,221.62	558,444.77
1956	3763	3544	7383	719,389.93	74,051.11	645,338.82
1957	3812	3733	7708	761,523.67	76,663.10	684,860.57

The following statement reveals the financial success of the system for the calendar years of 1951 through February, 1958:

Total Receipts		$3,549,296.64
Less:		
Bond and interest requirements	$422,867.33	
Operating and maintenance costs	393,120.13	
Reserve for renewal and replacement fund	71,666.66	
Reserve for bond redemption and interest	215,000.00	1,102,654.12
Revenue in Excess of Requirements		$2,446,642.52
Less:		
Purchase of callable bonds	$853,423.96	
Expenditures by city for extension of parking system	1,448,074.86	2,301,498.82
Balance		$ 145,143.70

Much of the success of the parking system is because of efficient administration and operation. Under close supervision of the city manager, a full-time operating manager directs operation and maintenance of the system, collection of receipts from meters and the sale of parking permits, and enforcement of rules and regulations governing the system.

Administration and Operation

Six servicemen, a watchmaker, and a utility man comprise the maintenance crew. Each serviceman has a designated group of parking facilities and checks each meter in his group at least once a week. Any needed repairs are made in the field, if possible; if not, at the maintenance shop, where all meters are completely overhauled at least once a year.

Four meter collectors make five daily collections each week. Each meter has a coin box which is locked by personnel in the city clerk's office. Before the box is inserted in the meter, a paper seal is placed over the key hole by the collectors. These paper seals are of various designs, a different one being used each time a box is returned to the meter. These seals are not broken until they are opened by the money-counting personnel in the city clerk's office. If a seal is broken, an immediate investigation is made.

Counting is done by coin sorters, and the counting room is so situated and so designed in the city clerk's office that all operations are readily observed. At least two people must be in the room.

Another safeguard is that both coin boxes and meters are numbered, and each box must go into the proper meter.

Occasionally, because of meter malfunctioning, coins slip between the box and the meter housing. Coins from each meter are placed in separate envelopes and turned in to the collection office. Accurate records are kept and the frequency of malfunctioning is reviewed from time to time.

Revenues are counted by zones. Therefore, an accurate determination of use of each facility is possible. Daily reports are received from the city clerk giving the amount collected in each zone. If, in the course of counting, a wide discrepancy is noted in the contents of individual coin boxes of a given zone, an investigation is made to determine the likely cause of this discrepancy.

Six women and four men are responsible for enforcement of meters. They are supervised by the manager of the parking system and are limited to enforcement of the parking-time limits of the curb and off-street meters. Enforcement personnel use motorcycles.

Efficient Records

Complete records are maintained for every phase of the parking system and for each of the forty-one zones in the system. As a consequence, income and operating costs can be accurately distributed and a high level of operational standards can be maintained.

Files pertaining to the distribution of revenues including fines have been quite effective. Special notations are made concerning violators in case several citations on the same vehicles have not been paid. This has been an aid in enforcement practices. Maintenance of a card index file containing all pertinent information relative to each individual meter has also improved maintenance and collection activities.

The excellent enforcement program is emphasized by the steady increase in revenues. As a result of good management, techniques have been developed continually to improve the very efficient operation. Proper corrective and preventive maintenance has kept operating costs to a minimum. These costs increased from $8.95 in 1951 to only $9.95 per meter in 1957. The increase in revenues was much greater proportionately.

Private Parking

The city has given serious thought to the development of parking by private property owners. The city council permits multi-level garages in certain multiple-family areas, subject to certain conditions and restrictions. A public hearing is first held to determine the effect upon traffic by the proposed facility. Permission may then be granted if the following conditions are met:

a. The building shall be fully enclosed and shall conform in outward appearance to that of other buildings in the area;

b. No exterior sign other than an identification sign shall be permitted, the location, design and size of which shall be approved by the city council;

c. The services rendered shall be restricted to the parking, washing and greasing of cars, and the supplying of gasoline, oil, water and air to such vehicles.

Although permits have been granted for such construction, no garage of this sort has been built.

Parking is required in certain multiple-family areas. In one district, requirements are as follows:

a. Single-family homes – one parking space per family unit;

b. Apartment houses – one parking space per unit for the first four family units and one parking space for each two-family units in excess of four;

c. Hotels – one parking space for each two hotel rooms.

In another district the following requirements are in effect:

a. Single-family homes – two parking spaces per family unit;

b. Apartment houses – three parking spaces for each two-family units;

c. Hotels – one parking space for each hotel guest room.

Miami Beach is considering seriously the establishment of parking space requirements for new construction in other sections of the city. Since there is a recent trend towards larger and taller multiple-family apartment houses, the city council has found it necessary during the study period to adopt a "stop-gap" ordinance. This provides two parking spaces for three living units. In the event a hardship is involved, the city council has the authority to waive or modify this requirement.

This problem requires careful analysis because only five percent of the property in Miami Beach is vacant, with many of the lots isolated and hemmed in by existing structures.

Some of the hardships encountered to date include:

1. Small lots;

2. Existing lease agreements providing for a minimum number of apartment units;

3. Existing mortgage agreements requiring a minimum number of apartment units;

4. Creation of hazardous conditions on heavily traveled thoroughfares where vehicles would be required to back into traffic.

The stop-gap ordinance has been in effect about one month and results have been extremely satisfactory. Each problem has been approached with mutual confidence, and to date there have been

no controversies. Many parking spaces have resulted that would not have been otherwise obtained.

Private parking lots containing facilities for more than three vehicles, irrespective of charge or no charge, require a special permit from the city council. These lots must have a smooth surface, be dust free with no loose particles and shall be adequately drained. They must be bordered along side and rear yards by opaque hedges or walls, unless the adjoining property owner waives the requirement. Permits are renewed annually.

To protect single-family estate properties, the zoning ordinance provides that no area owned and operated by the city can be located farther than 350 feet from a business district.

One parking space is defined as 160 square feet with clear access thereto.

City Anticipates Future Needs

In addition to the normal increase in demand for parking facilities being experienced by all flourishing cities, several unique factors will contribute to the need for expansion of the Miami Beach parking system.

The city is now constructing an exhibition hall on Washington Avenue north of Lincoln Road, the principal shopping area, which will accommodate conventions, trade shows and sporting events. It will adjoin an auditorium constructed in 1950 for conventions, sporting events, theatrical performances and concerts. The present auditorium has a capacity of 3,500. The new exhibition hall, which will be completed in October of this year, will accommodate 15,000 people and provide trade-show space of approximately 150,000 square feet, of which 108,000 will be in one room.

This building is so designed that it is capable of expansion. Parking space for approximately 700 vehicles will be developed in the rear, but large attractions will cause overflow into the Lincoln Lane parking area. Markings on the exhibition hall parking space will be painted rather than developed by curbs in order that the space can be used for oversize exhibition purposes. In these cases a tent cover is customary. This area will not be metered. It will not be open to the general public and will be used only for special events in the exhibition hall.

The effects of several improvements to ease traffic in and around Miami Beach are also being considered in the city's plans to meet future parking needs.

A new causeway which will be part of the Federal Interstate Highway System is now under construction across Biscayne Bay from 36th Street on the Miami side to 41st Street on the Miami Beach side. This causeway will have six moving lanes of traffic and is designed for 50 miles per hour movement. Bridges will be fixed and it will be the most important link between the two cities. It will make Lincoln Road and other central business areas in Miami Beach more readily accessible to mainland residents. This structure will be completed in approximately two years.

Another major causeway improvement is the reconstruction of the easterly and westerly viaducts of the MacArthur Causeway, which extends from Fifth Street on the Miami Beach side to Thirteenth Street on the Miami side of Biscayne Bay.

Reconstruction of the easterly viaduct is well under way and will be completed in about two months. It is expected that the state road department will commence reconstruction of the westerly viaduct within the next two years. This work will further improve the flow of traffic into Miami Beach.

Over the years Miami Beach has improved traffic movement over its streets by street widening and new bridge projects. It has maintained high standards in traffic engineering and control, and where necessary has synchronized traffic lights to permit traffic to move readily from one section of the city to another.

Financing Current Expansion Program

On March 12, 1958, the city sold $1,850,000 in parking revenue bonds. Part of the proceeds will be used to finance a parking-deck construction in the Lincoln Road area, and the remainder to acquire and develop additional parking facilities, principally in the vicinity of the 71st Street business area.

These are serial bonds due annually, commencing in 1959 and ending in 1978. These bonds rank on a parity with the still outstanding balance of $500,000 parking revenue bonds dated January 1, 1950, and both principal and interest are payable solely

from revenues of automobile parking facilities. The average interest rate for the 1958 Issue is 4.068 percent.

Beginning January 1, 1963, and on any interest-payment date thereafter, provided all of the 1950 series have been retired, and upon payment of an agreed premium, the 1958 series are optional for redemption prior to maturity as follows:

1. In inverse numerical order, from revenues derived from the system;

2. In whole, from any available funds.

Generally, provisions of the resolution authorizing the 1950 series remain in effect and are applicable to that series and to the 1958 series. Those provisions having to do with the distribution and handling of various funds (previously outlined) have been tailored so as to cover the new issue.

Specifically, the monthly deposit of $2,500 to the bond redemption and interest reserve fund has been increased to $5,000; and the amount that must be accumulated and preserved in this account before any surplus over such amount may be used to retire bonds in advance of maturity has been increased from $150,000 to $210,000; provided, however, that during the period while any of the 1950 bonds remain outstanding, the accumulation of the original monthly deposits of $2,500 over the original minimum balance of $150,000 will continue to be used for the redemption of the 1950 bonds. After all 1950 bonds have been retired, the accumulation of the monthly deposits of $5,000 over the minimum balance of $210,000 will be used for the redemption of the 1958 bonds and any future bonds issued on a parity.

Until such time as all of the 1950 series shall be retired, surplus revenues will continue to be treated as required in the original resolution. None of the 1958 bonds will be retired from surplus revenues until such time as the 1950 series have been retired; thus, one-third of such surplus revenues will be used to redeem bonds of the 1950 series prior to maturity, and the remaining two-thirds will be used either for the same purpose, or to extend and improve the system.

Upon retirement of the 1950 bonds, one-third of the surplus revenues will be used to redeem, prior to maturity, bonds of the 1958 issue, and such other bonds as may be authorized on a parity

therewith. As with the 1950 series, bonds of the 1958 issue may be purchased on tender or called in inverse numerical order.

Parking Demand Heavy in Business Section

Although increasing demand for parking facilities is city-wide in scope, it is particularly heavy in the Lincoln Road and contiguous areas. The demand in the Lincoln Road area is estimated at 5,100 spaces; in the area are 4,200 available parking spaces, a net deficiency of 900 spaces. It is to alleviate this condition that the city has contracted for the construction of the Lincoln Lane Parking Deck. This parking deck will provide 1,190 spaces on two levels, replacing 524 existing spaces. Upon completion, the theoretical space deficiency will be only five percent. (This does not include the exhibition hall parking area, one block north.)

Since the deck will be constructed in a critical parking area, the facility should be well patronized from the beginning. Construction was planned for the late spring and summer of 1958 during the off-peak season. The contract was awarded and work began April 1.

Completion has been scheduled for October 15, 1958. The contract provides that the contractor will receive a bonus of $300 for each day of completion in advance of October 15, and will pay a penalty in like amount for each day needed for completion after October 15.

Plans for the parking deck were developed during the administration of City Manager Claude A. Renshaw, now president of the Miami Beach Federal Savings and Loan Association, and the author who was then city engineer. Mr. Renshaw resigned as city manager March 1, 1958, to accept his present position, after having guided the affairs of Miami Beach since 1925. Mr. Renshaw contributed more to the planning and developing of the off-street parking system than any person connected with the official family of the city.

The proposed structure will be bounded by 17th Street on the north, Washington Avenue on the east, Lincoln Lane on the south and Pennsylvania Avenue on the west. It is estimated that the construction cost will be $1,000,000.

The new facility will have a ground-floor capacity of 553 spaces; 635 spaces will be provided on the second level. The second level extends over Pennsylvania Avenue and Drexel Avenue, both of which will continue as city streets. Entrance to the ground level will be afforded by these two streets. A direct ramp will be provided from Lincoln Lane to the second level, and inter-level circulation will be supplied by one set of straight ramps. Principal circulation has been planned around the perimeter, with the parking bays being oriented in a north-south direction.

Factors Determine Change

All the original parking bays were constructed in an east-west direction. Many factors, such as cost, number of spaces and ramp locations determined that the street-level portion should be reconstructed and reoriented. Ample stalls of nine-foot width, and aisles have been provided to meet present and future requirements.

Foundations are of spread footings resting on natural sand soil. Columns are reinforced concrete twelve inches in diameter. Main girders are of poured-in-place reinforced concrete. The deck joists will be of pre-stressed concrete supporting a four-inch cast-in-place reinforced concrete slab.

The original design called for an alternate consisting of pre-cast concrete slabs. The cost of the poured-in-place slab was slightly higher, but because that design assures more stiffness to the structure, the contract was awarded on that basis.

The deck slab will be covered with asphaltic concrete.

The lower level will be constructed of local compacted limestone with an asphaltic concrete surface.

A minimum eight-foot headroom will be provided.

Drainage of the deck will be effected by down spouts connected to an underground storm sewer system.

The lower level will be illuminated by fluorescent ceiling lights. This part of the system is so designed that, when necessary, some of the lights can function during daylight hours. Deck lighting will have conventional pendant street standards with incandescent lamps.

It is planned presently to defer construction of the ramp at the southwest corner. Experience has been that the parking areas gradually fill up during the morning periods. This practice poses no

problem to access of the deck by one ramp only. When there is a concentrated exit from the deck, police control will make the "up" ramp available for "down" movement.

Of paramount importance in all phases of the new structure's architectural design was consideration of the people who will use it. Catering to the permanent residents and to the millions who flock to Miami Beach throughout the year, the designers extended every effort to incorporate comfortable, functional and attractive features in the reinforced concrete structure.

With maximum use of the building anticipated during the peak tourist season, circulation problems of both vehicles and people were analyzed. Since the facility will be completely self-parking and meter-operated, a seven-foot island has been provided for meter posts and for a pedestrian walkway.

Placed at strategic positions around the perimeter of the huge project are stairwells offering access to each level. Each stairwell offers benches for tired shoppers, as well as pedestrian unloading platforms. Concrete cantilevers provide protection against sudden tropical showers. Functional and decorative handrails feature both horizontal and vertical hand-grip surfaces offering maximum support for people of all ages. The stairwells have been designed as focal points of the structure, and treads and risers are supported by a central concrete beam, creating an illusion of lightness. The steps extend over carefully planned planting bins.

As a special feature of comfort and function, one self-service elevator will be installed initially, to invite handicapped persons to make full use of the facility. There is space for a second one, if needed.

Pastel stucco tones, alternated with textured masonry walls completely devoid of applied ornamentation, harmonize with carefully selected plants that offer a tropical setting for the huge structure. All foliage starts at the lower level and extends above the upper deck, thereby producing a garden-type facade.

The completed project reflects the designers' efforts to provide maximum efficiency and a contemporary approach to aesthetic satisfaction within an economic development.

The remainder of the proceeds from the sale of the parking revenue bonds, series 1958, will be applied to paying the cost of acquiring land in the city's 71st Street business area, improvements

of this land as off-street parking areas, and the purchase and installation of meters therein. Development of Miami Beach commenced in the southerly end of the city. Inasmuch as the main ship channel to Miami harbor was a natural barrier against growth to the south, expansion naturally moved north. Each year sees the center of population moving in this direction.

Traffic generated by the North Bay Causeway and numerous business establishments in the 71st Street area recently was greatly increased when the new 538-room Deauville Hotel and 386-room (plus 52 apartments) Carillon Hotel were opened for guests.

Other recent construction in the area under consideration included approximately forty new retail stores in these new hotels, and ten apartment buildings containing 235 apartment units and seven hotel rooms.

The accelerating demand for parking facilities in the area around 71st Street is reflected in an analysis of the revenue derived from the meters in a city-owned parking area at 65th Street and Indian Creek Drive. The 1957 average revenue per meter in this zone was approximately 50 percent higher than the 1956 average, and the figure for the first three months of 1958 is 115 percent higher than the figure for the corresponding quarter in 1957. These increases reflect the effect of the new hotels, apartment houses, and stores opened in the area in the latter part of 1957.

The steady increase in the number of year-round residents and visitors portends an ever-increasing demand for parking space in all zones of the city's parking system. The persistent upward trend of revenues to date, and the very low operating ratio maintained through these years of increasing revenues, give promise that the excellent coverage of debt service requirements afforded by the earnings-record to date will be greatly enhanced in future years.

Concerning the city's success in dealing with the interrelated problems of traffic and parking, a firm of nationally-known city planners stated in a report dated July 22, 1957: "We have been impressed during the course of this study with the progress the city has made, both in major streets and parking, in keeping pace with the mounting demands of traffic. . . . Miami Beach has achieved outstanding success in its handling of an unusual parking problem and it is expected that the city will continue its leadership in the improvement of parking conditions."

The Benefits of Complete Programs For Urban Transportation Planning

BEN WEST

Mr. West has been Mayor of Nashville, Tennessee, since June 1951. He was Vice-Mayor from 1947 to 1951. He is also Chairman of the National Committee on Urban Transportation. Previously Mr. West was Vice-Chairman of the National Committee, and Chairman of the Committee on Streets, Roads and Highways of the American Municipal Association, etc.

AMERICAN cities have been provided for the first time with a factual guide to sound urban transportation planning. This Guide Manual, "Better Transportation for Your Cities," was pioneered by the National Committee on Urban Transportation to help cities and metropolitan areas develop practical overall plans for balanced improvement of all forms of local transport, including auto, truck, and transit service.

The guide was designed for use by mayors, city managers, councilmen, state highway engineers, transit management personnel, and department heads of local government. It outlines in detail how the program should be organized, what studies should be made and the order in which the work program should be accomplished. Supplementing this basic work is a series of fifteen procedure manuals to help officials and staff personnel carry out the specific factual studies recommended.[1]

This guide, with the manuals, embodies the most complete, authoritative transportation study and planning program ever developed. It is adaptable for any community or metropolitan area. The techniques developed are designed to guide the planning, financing, construction, operation and maintenance of street, highway, transit and terminal facilities for the best transportation service at the least possible cost; and to aid in attaining the objectives of sound community planning and development.

In the April issue of *Traffic Quarterly*, Glenn C. Richards presented the recommended overall planning program, its organiza-

1. List of available Procedure Manuals is appended.

tion, the specific studies to be carried out and a brief discussion of how the factual data are used to develop a sound transportation plan. The program recommended by the National Committee consisted of six basic stages:

Stage I	Organizing For the Job
Stage II	Getting the Transportation Facts
Stage III	Defining the Problem
Stage IV	Developing the Transportation Plan and Financial Program
Stage V	Adopting the Preferred Plan and Financial Program
Stage VI	Carrying out the Plan

In one way or another, most cities follow these basic steps to plan and construct certain transportation improvements. Few cities however have organized their efforts to serve the objectives of a coordinated transportation planning and improvement program that embraces all of the basic functions that should be performed on a continuing basis.

Although there are many other differences between piecemeal study efforts and the complete program recommended by the National Committee, this fundamental distinction in concept is the key to the many benefits and advantages to be gained.

Because the advantages of this program are numerous and since they will vary from one locality to another, this discussion is limited to benefits significant to most cities and urban areas using an organized program of this type.

In many respects, the advantages resemble a chain reaction in which a primary benefit often gives rise to a series of secondary values and by-products. Benefits presented, therefore, will be based upon the entire program rather than upon individual component studies.

Co-operation and Teamwork

Urban transportation problems are so complicated and vast that no one department or agency of local government can overcome all the difficulties. Close co-operation among local officials and among local, state and federal agencies is indispensable in creating and executing sound urban transportation plans and improvement programs.

The program is constructed to bring all officials with transportation responsibility into a working partnership from the beginning. This is accomplished in Stage I through a Technical Co-ordinating Committee of representatives of municipal departments and agencies, transit management, and such co-operating agencies as other cities in the metropolitan area, county, state and federal officials and special agencies or authorities.

Municipal officials normally represented would include the traffic engineer, director of public works (or city engineer), planning director, finance officer and city attorney. Thus all officials having a primary transportation responsibility are combined into a functional operating group with a single common objective. That objective is the development of a factual, orderly and continuous plan for transportation improvement designed to gain legislative approval and the necessary funds to carry it out.

This overall objective cannot be gained without public understanding and support. For this reason it is recommended that a citizens' advisory committee or committees be appointed to complement and work with the technical co-ordinating committee on a continuing basis through each stage and cycle of the program. This advisory group would normally be composed of representatives from the various civic, service and safety organizations, including community leaders from business, industry, labor, educational institutions and professional groups.

While this advisory organization will be in a position to help the technical co-ordinating committee in many ways, the most important contribution lies in developing and presenting an effective public information program. Public understanding and support are of vital importance in adopting a transportation plan and concurrent financial program by the legislative body.

It is essential, therefore, that citizens understand the plan and the issues, including the benefits. Without active citizen support, even the most advantageous plans will be difficult to carry out.

These technical and citizens' committees, working together as a team throughout each stage and cycle of the program, provide the springboard for many potential benefits. This partnership arrangement creates good will and a better understanding of transportation and other problems facing the community and the co-operating governments and agencies.

Because it brings key officials and citizens' groups together in a continuous effort, the program generates a spirit of harmony and teamwork, and fosters the improvement of interdepartmental and intergovernmental relations.

Once the teamwork approach is developed, it stimulates further co-operative action. It may well lead to such area-wide beneficial action as standardizing traffic signs, signals and markings, approving uniform traffic regulations, and adopting standards for classifying, designing, and constructing streets in a metropolitan area.

As evidenced in the pilot cities, the initiation of the program by one city has often crystallized the interest and co-operation of the entire metropolitan area. Understanding of transportation problems by all officials and agencies is one of the most important benefits. Without it, a complete transportation planning and improvement program cannot be approached with any real assurance of success.

Combining all officials who have transportation responsibility into a single operating unit has other advantages. It provides an opportunity to create a true functional relation between transportation, city planning and community development. One of the basic elements in preparing estimates of future travel desires is a land use plan. In preparing this plan, the planning official takes into consideration population growth, housing and urban renewal programs, future sites for public buildings, parks and recreation, and the potential development of vacant land. In this way, the transportation plan becomes a fundamental part of the community Master Plan.

Armed with such data, the preparation of a realistic transportation plan will be simplified and the community plan will reflect future conditions and transportation requirements with a degree of accuracy and vision that could not have been achieved in any other way.

Good experience in a transportation planning and improvement program may also help show the way toward the solution of other problems at both the community and metropolitan level. These potential areas include overall metropolitan planning and zoning, water supply and distribution, drainage and waste disposal, and airports.

It is important that patience be exercised in anticipating such

benefits. They will not appear within a few months, or upon completion of a few factual studies. Most of them will be realized only if the entire program is undertaken and carried out on a continuing basis over a period of time.

Pilot study experience, although limited to the fact-finding stage, indicates clearly that a co-operative teamwork approach provides direct advantages and beneficial by-products that would not materialize in other circumstances.

Factual Systematic Study Program

Transportation planning is fundamentally a decision-making process involving considerations of great magnitude. With traffic congestion, increasing accident rates, and rising transportation costs threatening the economic and social well-being of our cities and metropolitan areas, trial-and-error methods can no longer be justified.

It is essential that all planning decisions be based on sound factual data to provide the highest level of transportation service for demonstrated transportation needs and overall costs.

The National Committee's program provides for a complete series of factual studies so that cities may develop a repository of all essential basic data on a permanent continuing basis. It should be clearly understood that the information collected and developed from these studies is not an end in itself, but a means for attaining the overall objective – the development of a sound transportation plan and improvement program. The factual study and planning program are designed to be a unified co-ordinated operation. The separation made here is for discussion purposes only.

The factual study program has special built-in features that provide many benefits over and above the intrinsic value of data collected. Each study is designed to provide data that serve as an established functional link in each stage of the overall program. This means that the data to be collected have been carefully selected as to requirements in kind, and further controlled with respect to amount, thereby avoiding the collection of either too much or too little data. This procedure insures that all essential data will be available in terms of minimum cost and effort.

Properly organized and conducted, this systematic study pro-

gram serves the interest of economy by preventing wasteful duplication of effort. Generally speaking, the administrative organization of cities, as it relates to transportation, has developed haphazardly over a period of years. Often this has brought with it an unconscious yet wide division of responsibility and authority among related departments and special agencies having transportation functions.

Under such conditions, overlapping work and study programs are almost inevitable. In the fact-finding program recommended, each study is constructed so it can be carried out independently by a particular official, department or agency, with the assurance that the particular study will provide all necessary information if it is properly carried out. Therefore, unnecessary parallel or overlapping special studies producing different sets of unco-ordinated data can be readily avoided.

To provide additional values, the studies are designed so that information from one investigation will fit into and complement the facts collected in other studies. This provides an opportunity for the review and consideration of all information as a complete entity, so that the greatest overall values may be extracted for both operational and planning purposes.

The fact that the study program is carried out on a continuing basis enhances the value of the information gathered by keeping it up to date. A continuous co-ordinated study program, carried out according to the regular schedules recommended, makes it possible to observe significant trends or shifts in traffic volumes, accidents, parking and travel time as they occur. Thus the informational base provided by each original study becomes more valuable each time it is repeated. Once the initial cycle of factual studies is completed, many of them can be kept up to date by the sampling methods outlined in the procedure manuals. The factual study program is also adaptable for expansion if after a period of several years it is considered practical to extend the original factual base developed.

A special value of the program is its capacity to serve as a device for training local personnel in carrying out the required studies, the development of significant data, and their application to practical transportation planning and operations. This becomes possible through the procedure manuals for each specific program study.

While studies are technical in nature, the manuals are prepared

so they can be carried out satisfactorily by most available personnel with supervision in the first study cycle. Once the procedures are established, they will tend to become more routine and more natural. Personnel having the benefit of carrying out these studies and developing the data become much more valuable to the local government as a result of the added training and experience gained.

Study and planning experience by the local staff at the operating level also tends to precipitate valuable by-products. Studies developed by the local staff carry with them a sense of personal pride and accomplishment. Thus the program tends to inspire ingenuity, and the desire to do a better job. Close personal contact throughout the study program will also bring about a better understanding of the scope and nature of local problems at the operating staff level.

The principal benefits to be derived from the factual systematic study program may be summarized as follows: it provides economical methods and procedures to develop all facts and information necessary for the development of a complete transportation planning and improvement program.

Data collected are useful not only in the physical planning operation *per se*, but in financing, constructing, operating and maintaining facilities in accordance with the overall plan adopted. It serves both day-to-day operational needs and long-range planning objectives. The primary economies to be realized under this program stem from the careful selection of data to meet predetermined objectives, the study techniques used, and the fact that it is organized into a systematic, continuing program.

Complete Planning Program

The benefits reviewed up to this point are associated primarily with organization of the work program (Stage I) and the factual studies to be carried out (Stage II). Stages III through VI are centered on the development of a sound transportation plan and improvement program, gaining legislative approval and the funds necessary to carry it out. This is the focal point of the entire program recommended and a potential source for many far-reaching community dividends.

Compensations from a complete factual transportation plan are

numerous and interrelated; tangible and intangible. Furthermore, they do not end at the arbitrary line of improved transportation service and facilities in terms of lowest comparative costs, but in reality extend into the future of the community.

When the factual studies in Stage II have been completed, the data developed must be put to work to define the transportation problem (Stage III). With the information available, and by the use of the standards provided, it is possible to evaluate with accuracy all existing deficiencies and to project future needs on a realistic basis.

The special benefit provided is that this picture of needs can be made complete and presented in full perspective on the basis of fact. Properly prepared, it will cover every aspect of transportation service, facility, and community planning consideration. It is not limited to an origin-destination survey, transit survey or traffic volume study as entities in themselves.

Figure I shows the factual studies and how the data are used to accomplish this goal and substantiate the conclusions reached with respect to all types of transportation facilities and services, including streets, highways and transit. This shows a city where it stands transportation-wise: at the same time it promotes development of a well-balanced plan for overcoming present and future transportation needs.

With the aid of a sound plan, the legislative body will be in a position to determine a clear and realistic transportation policy to meet established needs. Such policy decisions are basic to a sound improvement program, which by necessity must include a workable financial plan, and the operational and organizational adjustments required to carry out the plan and maintain the system.

Without a complete plan based on factual evidence, such important decisions cannot be approached with justified confidence in any community. The absence of adequate plans and orderly, systematic improvement programs is without doubt a primary contributor to the urban transportation muddle.

A complete factual plan will also eliminate poorly planned and ineffective improvement projects. Those familiar with city traffic problems have heard at least one anecdote in which a widely-hailed improvement moved a basic capacity problem to another point on the same street.

Figure I

HOW BASIC TRANSPORTATION DATA ARE USED IN DEVELOPING THE PLANNING PROGRAM

Data Obtained From Basic Transportation Studies	*Reviewing Existing Conditions*	*Determining Deficiencies*	*Developing the Plan*		*Carrying Out The Plan*
			Major Improvements	*Minor Improvements*	
Street Use	x	x	x	x	x
Origin-Destination	x	x	x	x	x
Land Use	x	x	x	x	x
Street Service					
Traffic volume	x	x	x	x	x
Travel time	x	x	x		x
Street capacity			x	x	x
Accidents	x	x	x	x	x
Parking	x	x	x	x	x
Control devices				x	x
Transit Service					
Routes and coverage	x	x	x	x	x
Transit route inventory				x	x
Passenger load data	x	x	x	x	x
Service frequency				x	x
Transit travel times	x	x	x	x	x
Transit speeds and delays			x	x	x
General operating data			x	x	x
Passenger riding habits			x	x	x
Physical Street System	x	x	x	x	x
Financial Records	x		x	x	x

Source: "Better Transportation For Your City," Copyright, Public Administration Service, 1958.

While incidents of this type are convenient vehicles for storytellers, there is ample evidence that communities have invested and are continuing to invest their limited resources in projects that should never have been approved. This might include uneconomical street widenings, unsound maintenance programs, or the construction of new facilities that are either inadequate from the beginning or over-designed for the function they are to perform.

A sound plan will not only prevent unwise expenditures but will at the same time protect the investment in facilities provided. Hence properly planned residential streets will not become major thoroughfares within a few years, accidents will be reduced, transit service will be improved, traffic bottlenecks avoided, and overall transportation costs minimized.

The program conserves the city's financial ability to provide improvements that will have a specific function and permanent value. Under the provisions of the 1956 Highway Act, unprecedented sums will be expended in providing new streets and highways in cities and urban areas. A sound transportation plan developed in accordance with principles outlined will help to insure that these funds will be put to the most productive use.

Benefits of comprehensive transportation planning at the municipal level extend to other levels of government. When the 1956 Highway Act was first considered, it was evident that the states had ample data for estimating existing and future needs in rural areas. In contrast, cities and urban areas in general had little data to measure and substantiate street and highway deficiencies.

A clear, well-documented picture of urban transportation needs is essential to the development of policies and programs at state and federal levels. The inadequacy of the original estimates for the 1956 Highway Act again became evident when earlier this year it was announced that the new estimate for the Interstate System would probably be $40 billion, or $13 billion more than the total estimate upon which the big federal road building program was based.

While some of this increase in cost can be attributed to inflationary trends between the date of the original estimates and the actual legislation, a large portion of that difference is undoubtedly due to inaccurate estimates developed without benefit of adequate factual data and up-to-date plans.

Although community-wide benefits may take many forms, one of the most precious commodities the program can produce is community confidence – confidence in its future, and faith in its governing body. The cornerstone for these potential benefits was laid in Stage I, at which point all co-operating governments, agencies and officials combined into one functioning unit to develop the overall plan and program, in co-operation with a citizens' advisory group.

If the public information program recommended in the Guide is properly organized and conducted, all citizens are given an opportunity to review the plan and program on the basis of factual data and overall planning considerations presented. In this way, the citizen is made a part of the program. Though there will always be some who cannot be reached for various reasons, the majority of the public will be quick to recognize a sound, straightforward approach.

A public information program of the type recommended inspires confidence in the community and the government. First, the citizen is brought into the program *before* a plan is officially approved. He does not wake up one morning to read with surprise a vague announcement that a new freeway is scheduled to be constructed in the "general vicinity" of his home or business.

Such an announcement creates opposition, damaging rumors, and the impression that information has been withheld for dark and calculated reasons. Furthermore, a citizen is spared the confusion of trying to understand several incomplete plans developed by different agencies or levels of government. A factual plan, properly developed and presented, promotes public understanding and dispels unfounded fears.

Once a good factual plan and improvement program has been placed in operation, additional public confidence is gained through constructive improvements completed. Citizens will note the progress of the annual maintenance and repair programs, the construction of new facilities, changes in the operation and use of street and traffic facilities, and the fact that they get to work and home again with less difficulty. Public support gained in this way is an asset in any community.

A community can expect other benefits of far-reaching nature, especially insofar as business and industry are concerned. Almost

all cities would like to attract new business and industry to provide employment, broaden the tax base and promote community development. But business and industry choose their locations carefully. They make careful investigations before relocating or expanding their operations.

In addition to standard investigations of labor market, economic level and tax structure, they also appraise churches, hotels, restaurants, railroad facilities, local government administration, school and recreational facilities, and quite naturally, local transportation. A city or urban area with a poor system of streets and highways, unsatisfactory transit service, physical transportation facilities in bad repair and without an active plan for overall community improvement, will find it difficult to attract new business or industrial development.

The following quotation from the March 24th issue of *Time* magazine illustrates some of the advantages of advance planning:

Municipal Matters. The march of the highways is not always a boon to the small town. Hazel Crest, Ill. (pop. 4,000) has been pierced by the new Tri-State Tollway and would prefer not to have been. Reason: the town already had one of Illinois' highest tax rates and lowest school budgets. The tollway removes from the rolls property that brought an estimated $500,000 a year in taxes. Because of the tax loss, Hazel Crest schools have had to postpone plans for kindergartens and broader art, music and physical education courses. The tollway has also generated new expenses. Children who formerly walked four blocks to school now have to be carried by bus 2 ½ miles because of the tollway's limited access – and the school district has to foot the bill for the buses.

Proper Planning. Unlike Hazel Crest, Wilmington, Mass. (pop. 1,000) is delighted that Highway 93 pierces the town. Almost at the rumor stage, Wilmington four years ago began to plan for the highway, is prepared now to enjoy its benefits. The town used to lie 45 minutes from Boston by car over snaky roads; superhighway travel time is 20 minutes. Wilmington as a result is becoming a Boston bedroom. To handle the growth, the town's seven-member planning commission drew up tight zoning laws and a town meeting speedily approved them. Proper planning has already produced a bonus. Impressed by Wilmington's farsightedness, Avco Manufacturing Co. (electronics, aircraft engines, missile nose cones) is building there a $15 million laboratory that will employ 3,000 and provide an additional $180,000 in taxes.[2]

2. Courtesy *Time*; Copyright *Time, Inc.*, 1958.

If enough cities undertake the National Committee's program, the collective body of factual information would provide many opportunities for definitive research. A prime example is the complex study of determining the relation of land use to traffic generation. Equally important is an examination of transportation costs as they relate both to the level and the type of service rendered, including the benefits received.

Parking must be studied more closely to determine its relation to the community's economic base and the level of business activity. Other possibilities include shorter, more economical techniques for study programs.

Possibilities for research do not end with specific studies or projects, for transportation, as a means of movement and communications, extends into every phase of urban life. Intensive urban research must look ahead and begin to evaluate the physical, social, economic and political aspects of our growing metropolitan areas in relation to transportation facilities.

Pilot City Experience

In 1956, the National Committee selected seven pilot cities to field-test the preliminary study methods and procedures developed. Although pilot city experience has been limited in most cases to fact-finding studies, the benefits reported show that the program provides many advantages.

Following are benefits reported by Pheonix, Arizona:

The program has developed excellent co-operation between the city, (Maricopa) county, the State Highway Department and the Bureau of Public Roads. This was brought about by a more intimate acquaintance between personnel and the opportunity to discuss and resolve common problems. It has served to emphasize the urgency and need for co-operation and teamwork in such a rapidly expanding urban area.

The city and county have already taken some steps to unify controls and regulations, and it is expected that others will follow.

The basic data made available through the program indicate the urgent need for a revised master street and highway plan. The information collected and developed provides the opportunity to develop a street and highway plan on a sound, realistic base.

Revealed deficiencies will result in a re-evaluation of existing operations and work programs.

The program has made the general public more conscious of needed improvements, which in turn tends to promote a more favorable climate for meeting future needs.

Personnel participating in the program have gained valuable experience and training that will be useful to both the city and county. It has also made non-technical personnel more conversant with and aware of transportation needs and problems.

The study program has provided the incentive and nucleus for a continuing planning program between the city of Pheonix and Maricopa County.

San Diego reports similar broad benefits and several examples of benefits in specific areas. Co-operating with San Diego in this study are the California Division of Highways, San Diego County, the San Diego Transit System, six cities in the metropolitan area and the 11th Naval District. Benefits reported by San Diego are:

The pilot study program has developed closer co-operation and understanding between city departments. It has developed particularly close, harmonious and mutually beneficial understanding between the City of San Diego and the California Division of Highways.

The co-operative program has promoted closer understanding and co-operation among the seven cities, the county, the state, the transit system, and the 11th Naval District. It has brought about a closer working relationship between the San Diego transit system and the city. The program has developed and applied the administrative and technical approach toward the factual solution of specific major street and highway planning problems.

Management has been provided with new and useful information concerning street transportation expenditures.

Useful relationships between land use and travel characteristics have been determined. This has expedited the development of metropolitan area population and land use estimates, and encouraged the City Planning Department to undertake extensive land use studies toward the development of a land use plan.

It has developed useful factual data concerning existing street services, accidents, volumes, street capacity, cordon and screen line data, travel time, convenience of movement, and parking. The city has been provided with an inventory of the physical street system, including structures, lighting, and traffic control devices.

The program has produced a Deficiency Study and a 1971 Highway Needs Study, and has developed the relationships and methodology for intensive factual review of the Freeway and Major Street and Highway Plan.

Although study activity in San Diego has been concerned primarily with the fact-finding stage, that city reports interesting results with reference to several specific studies. A particularly successful example is the new accident records program implemented by the Police Department, which records accidents by street classification as recommended by the National Committee. The police traffic division reports that for the month of August 1957, approximately sixty-five percent of all accidents occurred on less than eighteen percent of the total street and highway mileage within the city; and of these thirty-six percent of the accidents on major streets occurred on only six major streets.

Of the 942 accidents recorded during that month, fifty-one percent occurred at intersections, approximately twenty-seven percent occurred on local streets, and eight percent on collector streets. This information is now being integrated with the traffic volume data developed in other studies to calculate accident rates by street control sections.

San Diego reports that this system gives the police traffic division a dependable, accurate and permanent method of securing factual data for the selection and assignment of personnel. After the original transition from the existing system is made, it appears that no additional personnel will be required to maintain this phase of the accident records program.

A second San Diego study revealing interesting results is the traffic control devices inventory. This study was carried out to locate, with reasonable accuracy, all traffic signs, signals and markings within the city. The inventory was designed for a machine records system to provide a complete knowledge as to the location, type and condition of these devices to aid in maintenance, budgeting, programming, initial ordering, replacement and removal of obsolete devices. It also locates unnecessary or non-standard traffic control devices. Thus it serves many purposes, including the objective of uniformity.

Although San Diego has for several years carried on a general program to standardize traffic control devices, it was found that there were 2,477 non-standard non-uniform signs, out of a total of 31,208 official signs in place, and 1,357 of these were in such condition that immediate replacement was required.

Aside from these discoveries, a major result was the development of a new machine record system for ordering traffic control devices. This system will provide the city with an accurate, accessible and currently-maintained traffic control device record system that can be analyzed and reproduced readily either in whole or in part. It also reduces the clerical work required under the previous system, and at the same time promotes safety by insuring that in the future all traffic control devices will be uniform, legible and properly located.

Another specific benefit reported by San Diego has to do with the application of factual data to major street planning between the La Jolla area and Pacific Beach. (See Major Street Planning Problems Solved by Factual Studies, Edward M. Hall, *Traffic Quarterly*, October 1957). Possible alternate routes were selected to provide a clear basis for the accumulation of factual data, including overall planning concepts, traffic service, design and the relative economy of alternate plans.

The city planning department prepared estimates of optimum future population and land development based on land use surveys, population projections, and subdivision practices. These data were used to prepare an estimate of future automobile trips, and in turn analyzed to determine cost data and study the possible effects on developed property for each alternate route. When all of these elements were combined, the route recommended provided the maximum traffic service to the public at the lowest cost and imposed the minimum adverse effect on land and its development.

In addition to the improved traffic service provided by the recommended plan, the city can expect savings of nearly $400,000 compared with the previous plan. Study costs were approximately $2,800, or less than one percent of the savings expected. San Diego reports that during the presentations of this plan, it became clearly evident that public acceptance can be readily obtained by using a *factual* approach to solve a difficult problem.

Evaluating Transportation Administration

The National Committee's program also provides for the evaluation of transportation administration and the legal authority avail-

able to meet the requirements of an effective overall planning and improvement program. These areas of investigation hold a great potential for most cities and local governments. The importance of evaluating laws and ordinances as they relate to transportation was well illustrated by the city of Pocatello, Idaho.

Although this study revealed a number of deficiencies, those of a basic nature were found in two areas: (a) the need for a modern, up-to-date zoning ordinance, and (b) additional authority for controlling traffic and the use of transportation facilities. Some of the additional provisions considered necessary under (b) above include:

1. Specifications for the location, design and operation of private parking lots and garages.
2. Provisions to foster private parking accommodations.
3. Regulations for commercial parking and terminal facilities, and
4. Terms and conditions for transit franchises.

It is interesting to note that this study was carried out by a senior student of Idaho State College under the general supervision of the city attorney and the city manager. The actual cost of the study was $196.63, including expenditures for materials and supplies. This shows how study procedures developed by the National Committee can expedite studies and investigations, and provide good usable information at minimum cost and effort.

Nashville is the first city to begin establishment of a transportation planning program using the new guides. A program director has been appointed and a tentative Technical Co-ordinating Committee has been formed. This committee includes members from not only the City of Nashville but also from the county, the state highway department, U.S. Bureau of Public Roads, and from the four small cities within the Nashville metropolitan area. Negotiations are in progress with the Tennessee Highway Department for the purpose of developing a functional and financial arrangement by which federal funds may be used to help finance the program.

The program is being well received and co-operation extended by all agencies involved. Apparently most officials in this area, each being harried with his own small segment of the overall transportation problem, have recognized that the problem needed to be

attacked on a much broader scale and they are looking to the transportation planning program to fulfill this need.

Technological advances and fast-moving development in transportation are rapidly transforming large portions of our country into great metropolitan areas. It is absolutely essential that action be taken to meet the new transportation requirements of cities and the changed pattern of contemporary urban life. These goals cannot be gained by sheer undirected activity. Improvement programs must be well organized and objective in approach, to make certain that substantial benefits will result.

The program developed by the National Committee is not a theoretical concept. It is a carefully organized approach to practical transportation planning. Although its application has been limited, there is no question concerning its values. As more cities and urban areas undertake the program, the impact of its benefits will become self-evident. The numerous advantages accruing to the city from having a factual orderly transportation improvement program will repay the original investment many times over.

Procedure Manuals Available

1A. Determining Street Use
2A. Origin-destination and Land Use
2B. Conducting a Home Interview Origin-destination Survey*
3A. Measuring Traffic Volumes
3B. Determining Travel Time
3C. Conducting a Limited Parking Study
3D. Conducting a Comprehensive Parking Study*
3E. Maintaining Accident Records
4A. Measuring Transit Service
5A. Inventory of the Physical Street System
6A. Financial Records and Reports
7A. Standards for Street Facilities and Services
8A. Recommended Standards, Warrants and Objectives for Transit Facilities and Services
11A. Improving Transportation Administration
12A. Modernizing Laws and Ordinances

* Manuals prepared by the U.S. Bureau of Public Roads and made available for this series.

In Preparation

3F. Determining Street Capacity
6B. Cost Accounting
9A. Developing the Transportation Plan
9B. Forecasting Traffic and Land Use
9C. Financing the Transportation Plan
10A. Establishing Project Priorities

All inquiries or orders for "Better Transportation for Your City" and the Procedure Manuals listed above should be sent direct to Publications Division, Public Adminstration Service, 1313 East 60th Street, Chicago 37, Illinois.

Thoroughfare Planning and People

HUGH R. POMEROY

Mr. Pomeroy has been Director of New York State's Westchester County Department of Planning since 1946. He is also an Adjunct Professor of Planning at Columbia University, lecturing on Planning Legislation and Administration; Zoning; Land Subdivision; and he conducts a Planning and Housing Round Table.

In 1954, and 1955, Mr. Pomeroy studied reconstruction and planning, with particular attention to the methods of control of land use and community development as a guest of the German Government. In November, 1955, he lectured at Karlsruhe, Germany.

Previously Mr. Pomeroy served as President of the California Planners Institute, as Director of the Virginia State Planning Board, and has prepared zoning plans and ordinances for the states of New York, New Jersey, Connecticut, Virginia, Georgia, Florida, and California.

THE Connecticut Expressway has improved living conditions along the Boston Post Road. Trucks that formerly thundered over a narrow route never designed for that much traffic now traverse a thoroughfare planned to carry them with ease and facility. Residential property along the Post Road can breathe again.

Effecting the Expressway was a battle from the first exploratory proposal to construction. An alternative route, advocated by a strong group of residents, would have run in the back country, getting out of Connecticut into Westchester County as quickly as possible. Members of that strong highway association lived in Connecticut shore communities through which the Expressway was proposed and through which it finally was built.

There was no battle of similar magnitude in Westchester County over the continuation of the Expressway, the New England Thruway, now near completion. This route, for the most part, made use of land acquired by Westchester County a quarter of a century before for the construction of an all-traffic parkway. To be sure, standards had greatly advanced, and the right-of-way had to be amplified considerably in places, and departed from, in some instances. Had the right-of-way not been available, the disruption would have been serious, with a staggeringly greater cost.

This is not to say that there were not some arguments over details, with proposals to alter the most feasible line. The southern

end, indeed, became part of an interesting composite in the complex of plans, planners, and people in highway planning. Southern Westchester County is a traffic throat out of New York City. All traffic out of the city destined for New England states, adjoining parts of Canada and upper New York state must pass through Westchester County.

There are three major "corridors" through the county for this traffic: in a belt along the Hudson River, longitudinally through the middle of the county, and in a belt along Long Island Sound. These are historic routes of travel, each marked by a post road dating from Colonial days – the Albany Post Road, the White Plains Post Road, and the Boston Post Road. In our modern concept of thoroughfare planning, each of these corridors should be traversed by an expressway and a parkway, in addition to supplementary intra-county routes.

This has called for the construction of new thoroughfares, such as the two routes of the New York State Thruway System – the completed New York to Buffalo route, and the New England Thruway – and the authorized Sprain Brook Parkway. It has called also for modernization of certain existing routes, such as the proposed reconstruction of the Hutchinson River Parkway.

Aggregate of Opposition

The need for these routes and for one other – an expressway to provide a modern facility to perform the through traffic function of the White Plains Post Road, which has become an attenuated city-village-town street seems almost self-evident. That's the over-all thoroughfare planning viewpoint. Detailed planning is carried on through consultation between the highway planning engineers, with a "center-line-from-here-to-there" attitude and the county planners (of both the Department of Public Works and of Planning), concerned with community effects.

So much for plans and planners. Every proposal for new thoroughfare construction or for thoroughfare reconstruction through these vital traffic corridors has been vigorously opposed. Opposition has come from those whose neighborhoods would suffer some disruption or whose property would be directly or closely affected. Critics have reflected deep personal concern. Their intensity can not

be ignored, and the validity in terms of the *immediate situation* of the affected property must be recognized. Yet, in the aggregate, the opposition for each route, when added up, constitutes an unbroken wall completely across the throat of the county, from Long Island Sound to the Hudson River.

Here the planner has a difficult task to perform. His relationship is advisory. If he is responsible to a local governmental unit that reflects a purely local attitude, his advocacy of the broader view may lead to his repudiation. If he is responsible to a governmental unit of broader scope, such as a county, the position he takes may impair his opportunity for effective advisory collaboration with important local governmental units within the county, which is an essential part of the county planning function.

The planner must be straightforward in presenting the facts that must be recognized in approaching thoroughfare planning problems, and be willing to take criticism from those who do not like the conclusions.

Also Thoughtful Consideration

The people as a whole represent a wide range of viewpoints in their attitude toward highway plans – from quiescent support, to acquiescence, to indifference, to inactive negativism, to active opposition, to belligerent hostility. The latter two viewpoints usually reflect the kind of sharp immediate interest that led to the "wall of resolutions" across the southerly throat.

They have more recently been expressed in public reaction to long-range proposals made by the Westchester County Department of Planning for a system of major thoroughfares for northern Westchester. These proposals were submitted for consideration to the officials of the eighteen municipalities in the area and thereafter for public discussion.

In some instances, a generally favorable expression has been accompanied by thoughtful recommendations for certain modifications, designed to provide a better relation to local community planning considerations, while assuring accomplishment of the major objectives of the proposed routes. Frequent consultation between the county planning staff and local officials is being devoted to working over details of the plan.

The town board (the governing body) of one town appointed a citizens' committee to advise it on the proposed routes traversing that town. On the advice of this committee, it recommended that the county planning commission withdraw the entire plan and take no action with respect to any route until it appeared that there was an early likelihood of authorization of a construction project for it. The county planning commission replied that to accede to this recommendation would be an abdication of the commission's responsibilities. While the town took the position that it did, it also gave the county planning commission some valuable suggestions as to certain modifications in the routes – just in case.

The supervisor of another town endeavored, with no support whatever, to have the County Board of Supervisors (the County's governing body) take the subject of thoroughfare planning out of the hands of the county planning commission and handle it through a committee of the board.

Precarious Opinions

The residents of another town feared that a proposed thoroughfare would interfere with fox hunting in the area. They were reassured by the statement that construction of that route was probably years in the future.

Any such assurance, however, must be given with the qualification that it is only an opinion of the likelihood of what the state might or might not do.

An example of the precariousness of such opinions occurred with respect to the route that caused apprehension among the followers of the hounds. In its search for a new location for a major north and south route, the state seriously considered using the route in question. Had they used it, it would have been construction, not after the fox hunting interest had waned, but well within the lifetime of the current supply of foxes. Further consideration led the state to consider another route, with alternatives between control points. This proposal is being met by bitter opposition by persons whose rural home environment would be disrupted by the highway, regardless of which alternative might be selected. The foxes would be undisturbed.

The reporting of news related to discussion of the thoroughfare

proposals by the press of the area has been thorough and accurate. Editorial comment has been perceptive and far-sighted. The press attitude has substantially strengthened planning in the area.

The attitude of the State Department of Public Works toward the entire undertaking has necessarily reflected its inability under present legislative provisions to plan much in advance of the actual authorization of construction. The "top command," therefore, has believed it could not engage in any discussion of the proposals, lest this involve the state in a multiplicity of local battles. Consultation with the state has taken place at a subordinate staff level, where there could be discussion without responsibility for conclusions. This consultation has been most productive, and has undoubtedly had the opportunity for a wider range of exploratory discussion than would have been possible at the top.

Effective Collaboration

A willingness on the part of the state is the first prerequisite for effective state-county collaboration in highway planning. But this is virtually useless, so far as results are concerned, unless it is met by competence in planning on the part of the county. The Westchester County Department of Planning has based its consultations on a painstakingly thorough knowledge of the facts and on a foundation of comprehensive planning for the county.

This of itself is not enough from the county end of it. While the department of planning is a focal point in the planning process in the County government, it is not the sole repository. The department of planning is a member of a team, working in close collaboration with the county department of public works and, where parkways are involved, with the park department. Each member of the team seeks to strengthen the participation of others – and thereby adds to its own effectiveness.

The result is that the state, in taking part in state-county collaboration, is not simply talking to a "bunch of planners" but to the representatives of a co-ordinated planning function in the county government. This is at the administrative level. Whenever a problem under consideration moves into the area of county legislative policy, the co-ordinated process in the county government extends

to consultation with the Committee on Highways, Parkways, and Thruways of the County Board of Supervisors.

This process of state-county collaboration in Westchester County has produced results of great public benefit. In an outstanding example of this, a shift in the location of a projected new highway route made possible the establishment of a wildlife sanctuary, in turn related to a larger composite of open land reservations, and facilitated the acquisition from the City of New York, by a nearby village, of a lake and surrounding lands no longer needed for water supply purposes by the city, but to be used for water supply and recreation by the village. An interesting aspect of this is that the sanctuary and other lands in the composite are being reserved, and the lake is being acquired, entirely through private philanthropy.

Realistic Appraisals

A comment on these excellent accomplishments is that they did not come about through "comprehensive, long-range planning" in the usual sense. Nor, in the circumstances, could they have resulted thereby, but through the operation of planning as a continuing process in the county government, in which the key feature is a clear "sense of direction" as to developmental policy.

In general observation on the reactions of the affected municipalities to the northern Westchester thoroughfare proposals, it can be said that, in the main, these have been characterized by thoughtful consideration of the problems involved and a high sense of public responsibility. There has been a realistic appraisal of some serious questions as to the validity of the entire process of long-range thoroughfare planning in the affected part of the county. The attitude of the town that asked for withdrawal of the plan was in considerable measure motivated by such questions. The part of the county covered by the proposed plan is lightly populated.

It consists of nearly seventy percent of the area of the county and contains only about twenty percent of the county's population. The entire territory is covered by municipal zoning regulations and these, in general, are of a high quality of competence. Within their land use framework, there is a broad flexibility as to the detailed forms that increasing development in the area will take. This,

obviously, gives wide latitude not only to the layout of local streets but to the locations of important intra-area traffic routes. Furthermore, this latitude extends beyond such routes to some aspects of the regional thoroughfares that comprise the northern Westchester thoroughfare proposals, in that there are usually to be found several satisfactory locations (from a highway planning viewpoint) for routings between major control points. The difficulty lies precisely here. With minor exceptions, all the proposed thoroughfares would be State routes, but the State has no way of committing itself to an exact route until it has authorized its construction.

This means, specifically, that the State Department of Public Works can not make a conclusive determination as to the location of any route until the legislature has appropriated funds for its construction. Thus, the County Planning Commission is proposing a plan of thoroughfare routes that would profoundly affect community development, but there is no way of assuring that there will be adherence to the plan by the state.

The two major purposes of the advance planning are to assure the future availability of rights-of-way for needed thoroughfare routes, without having to smash through development that may take place between now and then, and to provide a recognized major thoroughfare framework to which development can conform in accordance with sound principles of community design.

These purposes could be accomplished if the state had authority for the advance purchase of rights-of-way, without regard to the authorization of construction. In the first place, such purchase would be a sufficient commitment to enable local planning to be related to the proposed routes. Furthermore, the protection of rights-of-way of the magnitude proposed can not be assured by regulatory measures, either by the prevention of building within the proposed rights-of-way under official map procedure or by required conformity to them in passing on subdivision plats.

Recommended Width

Such protection could be provided for rights-of-way up to, say 100 feet or possibly even as much as 120 feet in width,[1] without un-

1. This statement is made with respect to the situation in northern Westchester as to sizes of holdings and prevailing range of sizes of subdivisions.

reasonably interfering with property rights, but not for rights-of-way of the proposed width of 400 feet. Purchase of the rights-of-way is the only possible means of protecting them. While the purchase of development rights (subject to statutory authorization, not now existing) would provide a means of protection, there would probably be little difference in cost – as to such rights-of-way – between the purchase of development rights and outright purchase of the land.

The recommended ruling width of 400 feet is based on the conclusion that the roadways of thoroughfares of the magnitude of those under consideration should be flanked by belts of land not less than 100 feet in width to insulate them from adjoining development. This conclusion was arrived at as a result of studies of the effect of various types of thoroughfares on the character and the stability of values of adjacent residential areas.[2] The conclusion is set forth as follows in a statement of "General Principles for Thoroughfare Planning in Westchester County," adopted by the County Planning Commission:

> Achieving the best results with respect to the relation between major thoroughfares and the areas through which they pass calls for ample marginal space and effective landscaping that will serve to insulate the main traffic roadways from adjacent development, particularly in residential neighborhoods, as well as provide a pleasant way to travel.
>
> These requirements normally call for a desirable over-all width (to be supplemented by additional land for interchanges with intersecting routes) of not less than 400 feet, of which at least half represents protective marginal landscaping. The exact width will depend on the width of center division and the depth of marginal landscaping, and on whether or not service roadways are included. In built-up areas it may be necessary to reduce the width of marginal landscaping, but an over-all width of 200 feet should be regarded as a minimum.

What is sought is the most satisfactory "impact" relationship between major thoroughfares and the neighborhoods through which they pass. To be sure, our experience in Westchester County and that in other parts of the metropolitan area indicate that houses will be built in situations in relation to traffic thoroughfares that seem strange to persons like the author of this article, who prefers to

2. Reported in "Traffic Impact," 1954 and "Changes in Westchester," 1955, published by the Westchester County Department of Planning.

live out in the woods at the far end of a dead-end road. Houses will even be built with direct frontage on a heavy traffic thoroughfare – if protected by zoning that can be relied on. There is no assurance of such protection in mere good intentions: it must be derived from the solid evidence of long practice.

Land Demand

All over the metropolitan area, houses are being built close to major thoroughfares, especially those confined to passenger traffic. They seem almost to snuggle up to the landscaped strips flanking the parkways. This is due in great measure to the vast land demand of a tremendously increasing suburban population. Selectivity on the part of the housing market is largely related to general location in relation to place of employment and does not necessarily display a high degree of sensitivity with respect to situation in a particular development. To a Manhattan apartment dweller moving out to the suburbs, a sixty-foot lot looks at first like all outdoors and the noise of even the heaviest traffic thoroughfare may seem like a murmur compared with the incessant clamor of the big city. An athletic team from the Bronx, housed in Westchester for the night preceding a game with a Westchester team, was unable to sleep in the awful silence of the country!

These pressures of population increase on the land and the evaluations associated with them may be expected to continue for a considerable number of years, as the metropolitan areas throughout the country continue to absorb the greater part of the nation's population increase and as most of this metropolitan growth occurs in suburban areas. But something more is needed as a determinant of standards of community design than the demand, or the tolerances, of the current housing market. The patterns into which open land is crystallized by "development" will have to be lived with from then on.

Long-range maintenance of community quality and of property values must take account of the fact that fewer persons are willing to live in close proximity to a traffic thoroughfare than are not, and that as time goes on there may be expected to be a more sensitive selectivity as to the situation of the house on the part of home seekers. The best means of establishing a relationship between

major thoroughfares and adjacent land use that will assure maintenance of the quality of the latter is to separate the two by adequate space.

Our concern in Westchester is with more than merely avoiding marginal erosion of neighborhood quality. Our concern is also for that part of the population that starts out with a desire for spacious building sites – perhaps up to several acres in area – in neighborhoods for which quiet and seclusion can be maintained over at least a sufficient time to justify expenditure for new house construction.

Spacious insulation of the thoroughfares margining or traversing such neighborhoods – burying the thoroughfares in park belts, as it were – is one essential to the protection of neighborhood quality. Accomplishment of the desired result requires greater width of insulation than in small-lot neighborhoods, for the depth of the impact of the thoroughfare into the neighborhood increases in a reverse ratio to the density of neighborhood development: such a neighborhood, with its quality bound up in quiet and seclusion, is greatly sensitive to disturbing influences. That is why it is fundamental, in the Westchester concept of major thoroughfare planning, that there be as few routes as may be necessary to serve through traffic requirements, leaving large areas unpenetrated by major thoroughfares. This makes it essential that these routes be provided with adequate capacity.

Planner's Hardest Task

The process of state-county collaboration thus calls for more than adjustment of details of alignment. It requires relating the individual thoroughfare to a thoroughfare system and it requires relating the entire structure of the system to the structure of a broad-scale land use plan. A neighborhood can not possibly be given long-range assurance of quiet and seclusion unless that kind of neighborhood, in that location, fits into the pattern of a comprehensive land use plan. Nor is any such assurance possible unless there are, in fact, provided adequate thoroughfare routes of great magnitude.

What is probably the planner's hardest task is to convince the people of the basic importance of these facts. The first reaction to a new thoroughfare proposal is likely to be "It isn't needed." On this point, it is reasonably certain that no group of property owners will

be able to develop facts, no matter how competent the technical assistance that they may call on to produce them, that will prove the state to be wrong in its conclusion that the thoroughfare is needed. Once over this hurdle and convinced that the thoroughfare is necessary, or at least inevitable, the almost certain next reaction is "Put it somewhere else."

The demand that the thoroughfare be "put somewhere else" is entitled to the fullest consideration. Even if long-range plans have indicated a particular routing for a thoroughfare, those who feel that they are adversely affected by it have a right to know that it is the most satisfactory location that can be selected, taking into account all pertinent facts as to present situation and future needs, as the same appear at the time that conclusive action is undertaken.

One parkway connection proposed by the state gave rise to intense local opposition. The county, through an interdepartmental undertaking by the Departments of Public Works, Parks, and Planning, carefully studied seven alternative routes. The study took into account through-traffic requirements, relation to thoroughfare system plans, relation to adjacent areas in terms of both immediate conditions and long-range development probabilities, design layout, and cost. (The study was estimated to have cost about $30,000 in staff time). The answer was that the line proposed by the state was by far the most feasible. The opponents were not happy with the result, but they recognized its validity.

There is no universal formula for making people happy about proposed thoroughfares. Reactions don't vary much, whether the thoroughfare be one proposed for construction sometime in the future in the open areas of northern Westchester or one soon to be sliced through a developed neighborhood in Brooklyn. Opposition is expressed about the same way: "It isn't needed; Put it somewhere else; We don't want it."

Principles of Procedure

While there is no pat policy, there are sound principles of procedure and conduct that should be observed. The first, obviously, is that the thoroughfare proposal should be based on competent planning, both for the particular route and for the thoroughfare system of

which it is a part, and that this should take account of the two considerations of producing a satisfactory result from a traffic standpoint and relating the thoroughfare to community development plans. The second is that people are entitled to full information and an opportunity for full discussion. This should begin during the early stages of the planning. It is well if the brunt of possible opposition can be taken during the course of basic planning for the thoroughfare system, in order to minimize a focalizing of disturbance on a particular proposal when it is authorized for construction. Some of the heat can thus be taken out in advance.

Let there be no mistake: The focalized opposition to specific proposals can be mitigated by advance discussion but can not be avoided. For one thing, the specific proposal has an immediately menacing aspect that is absent from the more basic planning. Furthermore, the time-lag between the basic planning and the presentation of a specific proposal may have allowed an evaporation of tolerance developed by early discussion. Also, conditions may have changed. Or different people may be involved as a result of changes in residential occupancy in the neighborhood.

Even if a neighborhood has lived with a proposal for a long time, activation of the project may arouse resistance. As an illustration, some of the land had early been acquired for the parkway connection referred to above as the subject of inter-departmental study. Although this was well known, it did not in any measure lessen the opposition when construction of the link was actually proposed.

Another essential to working out solutions is understanding on the part of the planner – understanding of the deep concern of the people with whom he is dealing – coupled with patience, continuing patience, and more patience. This goes along with the attributes of forthrightness and willingness to take criticism and even abuse that was referred to earlier.

There should be understanding on the part of the people, and a degree of civic responsibility that it is willing to recognize a larger community interest to be served.